

# Review of the Genus *Chironitis* LANSBERGE, 1875 I: Taxonomy, Phylogeny and Zoogeography of the Palearctic Species

(Col. Scarabaeoidea, Onitini)

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## Abstract

The taxonomical importance of the genitalia (♂ and ♀) within the genus *Chironitis* LANSBERGE, 1875, is studied. In agreement with the results of this study, the status of twelve palearctic taxa presently included in this genus is discussed. The conclusions obtained are summarized in the following list of species, subspecies, and new synonyms:

*Ch. hungaricus hungaricus* (HERBST, 1789) **ssp. nov.**; *Ch. hungaricus irroratus* (ROSSI, 1790) **st. nov.** (= *Ch. pamphilus* (MÉNÉTRIÉS, 1849) **syn. nov.** and = *Ch. phoebus* REITTER, 1893 **syn. nov.**); *Ch. furcifer* (ROSSI, 1792) (= *Ch. klapperichi* BALTHASAR, 1956 **syn. nov.**); *Ch. moeris* (PALLAS, 1781); *Ch. baroldi* (BALLION, 1870); *Ch. sterculius* (BALLION, 1781); *Ch. hauseri* REITTER, 1893 and *Ch. candezei* LANSBERGE, 1875. Likewise, *Ch. granulipennis* REITTER, 1909 is considered to be a probably good species. The status of *Ch. klapperichi* Balthasar, 1956 is also discussed.

In agreement with these taxonomical conclusions, the corological data and current ideas about the paleogeographic evolution of the mediterranean basin, an hypothesis about the taxonomical (subspecific) divergence within *Ch. hungaricus* is established.

Finally, some preliminary ideas are advanced about the possible phyletic relationships of the species studied, taking the mediterranean species of *Bubas* and *Onitis* (subtribus Onitina) as Outgroup.

## Introduction

Starting in the last decade and continuing to the present, there has been an in-depth review of the systematic of the dung beetles Scarabaeoidea. Investigations of different authors, principally Italians, based on the study of genitalia of both sexes, have provided new methodological criteria and conceptual bases which assist not only with the taxonomical task, but also with the establishment of the phylogenetic relationships among and

within different taxonomical categories. Some of the works most representative of this line of investigations, dealing with several groups of dung beetles Scarabaeoidea may be cited: ZUNINO (1983, 1984 a and b and 1985) with respect to Scarabaeinae, Geotrupinae, Taurocerastinae and Phanaeina; MARTIN PIERA & ZUNINO (1985 and 1986), PALESTRINI (1980, 1982, 1984) and ZUNINO (1979) with respect to Onthophagini; SIMONIS (1985) and SIMONIS & ZUNINO (1980) with respect to Oniticellini.

In agreement with this methodological criteria, I discussed in a preliminary way the taxonomic and systematic value of the genitalia of both sexes in the palearctic species of the genus *Chironitis* (see MARTIN PIERA; 1982). Putting together those initial conclusions now, I propose carrying out the taxonomic and systematic review of the genus *Chironitis* within the framework of a complete revision of the phylogeny and historical biogeography of the subtribus Onitina (sensu ZUNINO, 1985). This revision will deal successively with the remaining genus of said tribus.

This first paper begins, as its title indicates, with the study of the palearctic taxa of the genus *Chironitis*.

### The Genitalia in the Genus *Chironitis*: Its Taxonomical and Systematic importance

In the following, a generalized description of the male and female genitalia of the genus *Chironitis* is given, devoting special attention to those characters that the author considers important from the systematic and taxonomic point of view. This will allow the latter carrying out of the taxonomic discussion.

However one should anticipate that except for the particular characteristics of each one of the species of *Chironitis*, the generalized genital model of this genus coincides fairly well with that of other genus within and outside the subtribus Onitina (see ZUNINO, 1974 and 1985).

#### Male Genitalia

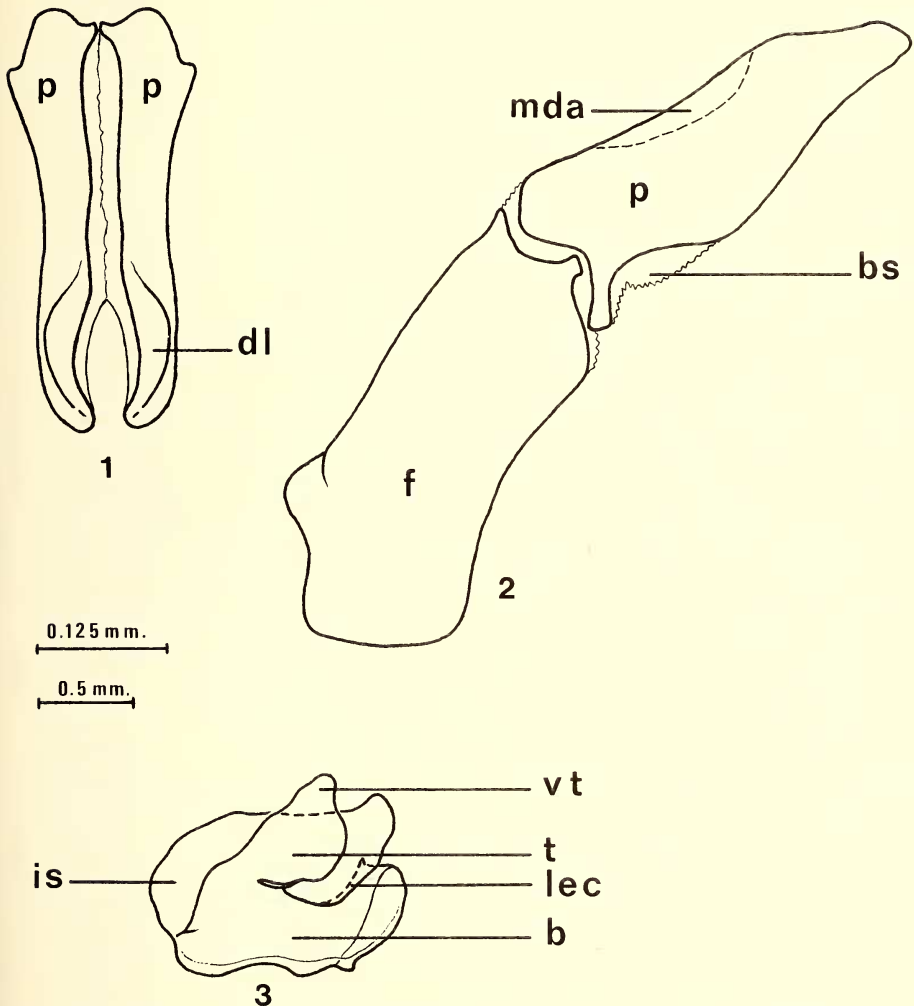
(Figs. 1, 2, 3 and 4)

As commonly occurs in all dung beetles Scarabaeoidea, the phallus or aedeagus in the genus *Chironitis* consists in a single cylindrical, hollow piece, the phallobase or tambour (of the french authors). In its apical region two structures, the parameres, are articulated. They are usually well developed and on occasion longer than the phallobase (i. e.: *Ch arrowi*). Between both parameres, there exists a not very extensive dorsal membranous area. The apex shows a morphology characterized by processes and lobular expansions of variable direction and conformation. In lateral view, the basal area shows a deep, wide sinus. In ventral view a membranous area extends between both parameres, whose pavimentum is sometimes partially sclerotized in its basal portion (fig. 2).

In a position of rest, the phallobase contains the internal sack or endophallus folded on itself and apically connected with two symmetric and partially joined median struts. Their prolongation, a membrane, joins them to the medial and internal margin of the pa-

rameres, which delimit a sagittal opening through which the internal sack is evaginated during the copula.

The endophallus shows internally a series of sensitive areas with setae and sclerotized structures of complex spatial configuration. All these structures correspond to those which are mentioned in the systematic literature, and more concretely, to those that were



Figs. 1 to 3: Male genitalia of the genus *Chironitis* Lansb. Fig. 1: Parameres, frontal view; fig. 2: Aedeagus; fig. 3: Copulatrix lamina. b: base; bs: basal sinus; dl: dorsal lobe; f: phallobase; is: internal side; lec: lateral external concavity; mda: membranous dorsal area; p: parameres; t: *tectum*; vt: vertex of the *tectum*. The greater scale (0,5 mm.) corresponds to aedeagus, the smaller (0,125 mm.) to copulatrix lamina.

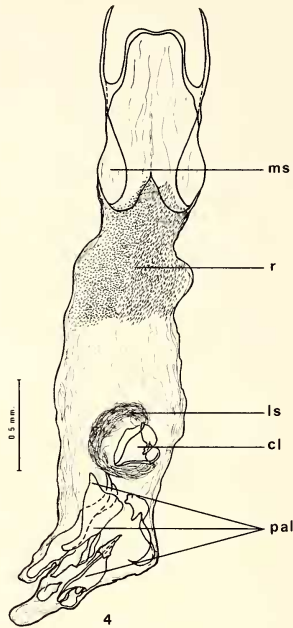


Fig. 4: Endophallus; cl: copulatrix lamina; ls: laminar sack; ms: median struts; pal: groups of accessory laminae; r: raspula.

described in 1969 by BINAGHI, DELLACASA & POGGI in the *Onthophagus* of the *ovatus* group: i) in the nearness of the gonopore: The Raspula, very extensive and constituted by two areas, one sprinkled with little conic setae and the other having abundant setae which take the form of little points; ii) in the opposite pole, a group of sclerotized structures of very complex spatial disposition: The Group of Accessory Laminae, iii) between both, another single sclerotized structure also of complex design and with a high taxonomic value: The Copulatrix Lamina and iv) looking toward this lamina a small laminar sack (fig. 4).

Of all these structures, that which has shown the greatest taxonomic value is the copulatrix lamina, which in the genus *Chironitis* has a wide laminar base of variable convexity (in some species it may be almost flat) whose most relevant characteristic is the tectum (x), sometimes very spatially complex. From now on I will conventionally denominate as the ventral region of the tectum those that which is situated above and in front of the base of the lamina. The opposite side will be denominated the dorsal region. Likewise, I will speak of the dorsal region of the lamina, to refer to the side which supports the tectum, convex in almost all species studied. The ventral region is the opposite one.

(x) That which is defined here as tectum is quite different from the tectum defined by BOVO & ZU-  
NINO (1983) in the Geotrupinae.



The vertex of the tectum is its postero-apical region prolongation, which projects in the dorsal direction, and usually, but not necessarily, ends in a sharp angle. Finally, the region where the base and tectum are joined will be denominated the lateral internal region of the copulatrix lamina. The name lateral external region will indicate the opposite one. Frequently, the latter shows a concavity as a result of the partition of the external margin in two lobes, one dorsal and the other one ventral. Both are joined internally (fig. 3).

### Female Genitalia

(Figs. 5)

The female genitalia is characterized by the existence of an extensive membranous area transversally folded and sclerotized, which I denominate the Genital Plate. Besides the transversal fold, the genital plate shows abundant folds of variable depth and direction, particularly in the region surrounding the genital opening.

The genital plate is the non-differentiated region of the oviduct, whose dorsal wall, covered by the transversal fold, is joined to the ductus receptaculi (fig. 5), which leads to a receptaculum seminis or spermatheca characterized by: i) the reduction of the membranous area of flexion whose basal part is joined to the duct of the gland of receptaculum; ii) the enlargement of the apical region, usually thick and iii) the more or less spherical conformation of its proximal region.

We may distinguish two regions in the ductus receptaculi, one proximal included in an evagination of the oviduct's wall (ZUNINO, 1985) and another distal one, in which the duct is nude until it reaches the spermatheca.

The genital plate continues dorsally in a double fold which separates the final portion of the rectum from the genital opening. Therefore the anogenital vestibule of the female receives dorsally the anus, and ventrally the genital opening.

Neither a vagina nor a Bursa Copulatrix exist in differentiated form. It is possible that this double fold of separation between the final portion of the rectum and the oviduct

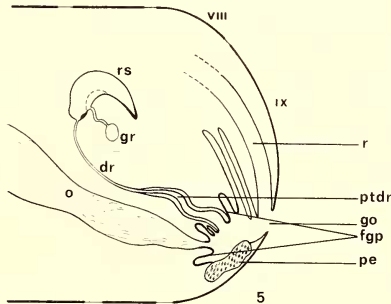


Fig. 5: Sectional view of the abdomen of *Chironitis* female, showing the genital anatomy. dr: ductus receptaculi; fgp: folds of genital plate; go: anogenital vestibule; gr: gland of the spermatheca; o: oviduct; pe: paranal sclerites; ptdr: proximal tract of the spermatheca; r: rectum; rs: receptaculum seminis or spermatheca.

acts as a receptaculum of sperm during the copula. However, at the moment, this is a mere speculation.

Finally, it's fitting to point out the existence of two hollow, glabrous or hirsute, and scarcely sclerotized structures on both sides of the anus: The Paranal Sclerites (HEYMONS, 1930).

Of all these structures, those that have proven to be of greatest taxonomic value are: i) The general morphology and internal folds of the genital plate, particularly those that surround the genital opening; ii) within certain limits of intraspecific variability, the receptaculum seminis and iii) in some taxa, the paranal sclerites.

### Material and Methods

The greater part of the material used in this work is kept in the collection of the Museo Nacional de Ciencias Naturales of Madrid (Spain); Department of Entomology (MNCN). Likewise, the author has studied material from other private and official collections: Instituto di Zoologia Sistemática dell'Università di Torino, Collection Mario Zunino (MZ); Institut Royal des Sciences Naturelles de Belgique (RISN); Zoologicheskij Institut A. N. S. S. R. (Leningrad) (MZAC); Zoological Department of the Hungarian Natural History Museum (MHNH); Museum für Naturkunde der Humboldt-Universität (Berlin) (MNHU) and the private collection of Mr. José Ignacio López Colón (JILC).

The study of the genitalia (♂ and ♀) has been made using techniques which are now commonly employed in studies of these coleoptera (ZUNINO, 1978). Nevertheless, we must point out some aspects related with the orientation and study of particular anatomical details which are proper to the species of *Chironitis*, especially those relating to the copulatrix lamina and the whole of female genitalia.

After uncovering the copulatrix lamina (to which access is gained by the sectioning the laminar sack), it is oriented in dorsal position, pressing the base slightly between coverglass and slide, in such a way that the tectum is placed in the foreground.

The female genitalia was always studied in dorsal position, pressing slightly on the genital fold. In this way, all the insertion of the ductus receptaculi is uncovered. Due to transparency, the folds of the genital plate may be observed in this position.

### Taxonomy

#### A.— Study of Taxa

##### *Chironitis candezei* LANSBERGE, 1875

*Chironitis candezei* LANSBERGE, Ann. Soc. Ent. Belg., 18, 1875: 21 and 31.

## Taxonomic remarks:

*Chironitis granulipennis* REITTER, 1909 has been considered by all authors to be a synonym of *Ch. candezei*. Nevertheless, the comparison of the Types of both taxa reveals clear differences, not only with respect to feminine genital armour, but also with respect to some external characters:

The female genitalia of *Ch. granulipennis* (fig. 6) shows a strongly sclerotized, elliptic genital plate, and with folds, one of which is also elliptic. With respect to the external morphology, the diagnostic characters used by JANSSENS (1937) to identify *Ch. candezei* do not correspond to the characters of *Ch. granulipennis*. In fact, the latter has not yellow pilosity of *Ch. candezei*, but brown or black; the basal flange of the pygidium is not regularly curved as in *Ch. candezei* but shows a median angle; the second third and fourth elytral intervals have not big tubercles (*Ch. candezei*) but show a normal and large granular punctuation; likewise, the fifth, which in *Ch. candezei* is very elevated (almost



Fig. 6: Female genitalia and spermatheca of *Ch. granulipennis* Reitt. (Type). For all following figures the greater scale (0,750 mm.) corresponds to female genitalin, the smaller (0,125 mm.) to spermatheca.

rib-like), is feebly elevated in *Ch. granulipennis*; finally, while the medial hull of the mesosternum in *Ch. candezei* terminates brusquely in an angle, in *Ch. granulipennis* (perhaps due to the difference of size between both types), it ends in a regular curve. These reasons allow us to conclude that *Ch. granulipennis* is not a synonym of *Ch. candezei*. So, what is the taxonomical status of the *Ch. granulipennis* ?.

From what has been previously said, it follows that we are dealing with a good species. As only one female specimen of each of the two taxa have been described (the males have not been), it is not possible to discuss a forementioned problem of taxonomic status at this time.

Studied Material: Type ♀ (MHNH) with the following labels: i) green manuscript: 29-IV-09 Kerin; ii) printed: 51; iii) white, manuscript: *Chironitis granulipennis* Reitter, Holotypus, 1909, ♀; v) white, manuscript: *Chironitis granulipennis* m. n. sp. 1909 and vi) white, printed: coll. Reitter.

#### External Morphology:

LANSBERGE, 1875; JANSSENS, 1937; BALTHASAR, 1963.

#### Female Genitalia (fig. 7):

Genital Plate triangular, little sclerotized, without folds surrounding the genital opening. Glabrous and small paranal sclerites. Spermatheca semicircular. Area of flexion very small. Insertion of the ductus receptaculi tubular and very narrow. Large gland of the spermatheca. Apical region with moderately thick walls in the distal half.

#### Geographic Distribution:

Mesopotamia (LANSBERGE, 1875, JANSSENS, 1937 and BALTHASAR, 1963).

#### Studied Material:

Type ♀ in RISN, with the following labels: i) white, printed: Coll. R. I. Sc. N. B., ex coll. Candéze; another manuscript stuck on top: Mesopotamia; ii) white, manuscript: det. van LANSBERGE, 1875 "*Cheironitis*"; another manuscript stuck on top: Candézei Lansb. Mesopt; iii) red, printed: Type; iv) white and manuscript: cf. Ann. Soc. Ent. Belg., XVIII, 1875, p. 31; vi) white, printed A. JANSSENS vid. 1936; manuscript: *Chironitis candezei* LANSB.

### ***Chironitis furcifer* (ROSSI, 1792)**

*Scarabaeus furcifer* ROSSI, Mant. Ins., I, 1792

*Onitis furcifer* (ROSSI), Olivier, Encycl. Méth., 1811 (1812): 490.

*Onitis pugil* COSTA, Fauna Napoli, Coleott., 1853, 14(4): 22.

*Chironitis furcifer* (ROSSI) Lansberge, Ann. Soc. Ent. Belg., 18, 1875: 21, 45.

*Onitis syphax* FAIRMAIRE, Ann. Mus. Civ. Genova, 7, 1875: 506.

*Chironitis metasternalis* REITTER, Wien. Ent. Zeit., 13, 1984: 302

*Chironitis theryi* TONDU, Ann. Soc. Ent. Fr., Bull, 1907: 275.

## Taxonomic remarks:

BALTHASAR described in 1956 (Acta Ent. Mus. Nat. Pragae 30: 411–413) a species phylogenetically related to *Ch. furcifer*: *Ch. klapperichi* BALTH. In fact, the study of one male and one female of the latter, allows us to confirm that no important difference exists between both taxa, with respect to their genitalia and the external morphology. On the contrary, it is easy to conclude that *Ch. klapperichi* fits perfectly within the limits of interspecific variability of *Ch. furcifer*. In fact, the process of the anterior femur in the males of *Ch. klapperichi* shows a development different from that of the larger males of *Ch. furcifer* (see BALTHASAR, 1963 p. 13; figs. 5 and 7), but not very different from that of the smaller males of the latter species, in which such process can vary extraordinarily. Identical considerations could be made with respect to the prosternal "furca". On the other hand, the surface of the metasternum are quite similar. Finally, let's underline the different punctuation of the pronotum: Males of *Ch. furcifer* have a rough punctuation in the disc and towards the anterior region; in the females, the same region is densely granulated. On the contrary, males of *Ch. klapperichi* have a large, dense, but simple and most superficial punctuation, and it is deeper in the females.

The isolation of this last taxa (Afghanistan) with respect to *Ch. furcifer* may lead one to consider in the future its taxonomical status (e. g. subspecies). Cases not exactly similar

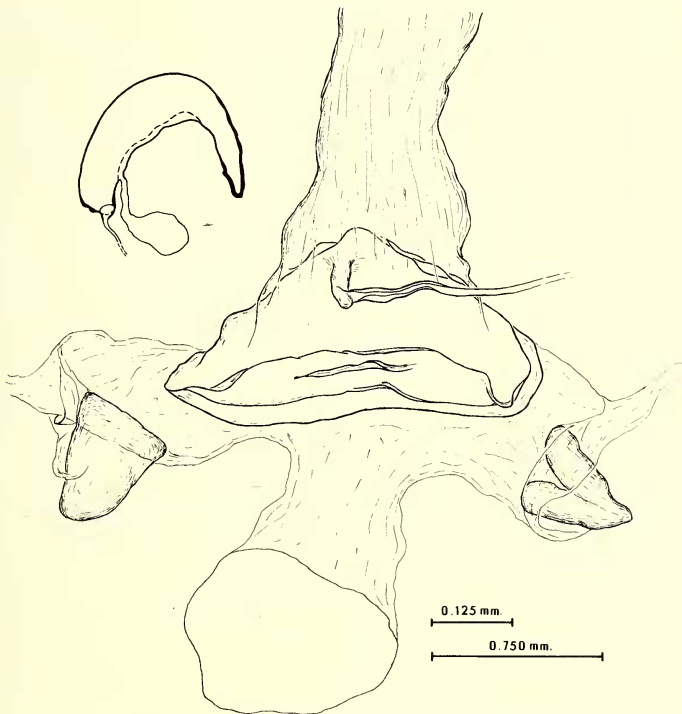


Fig. 7: Female genitalia and spermatheca of *Ch. candezei* Lansb. (Type).

in some other genus of Scarabaeinae are known; for instance, *Euonthophagus gibbosus gibbosus* and *E. gibbosus schnabeli* (see PALESTRINI, VAROLA & ZUNINO, 1979). However, the final conclusion about this problem may only be obtained by studying the variability and geographic distribution of both taxa.

#### External Morphology:

LANSBERGE, 1875; JANSSENS, 1937 and BALTHASAR, 1963.

#### Male Genitalia (fig. 8):

Parameres and phallobase of almost equal length; the latter slightly longer. Apical region of the parameres in form of a pincers, convergent towards the sagittal axis; its internal side concave; the apex blunt. With a dorsal lobe also concave in its dorsal side, which extends along the apical third of the paramere.

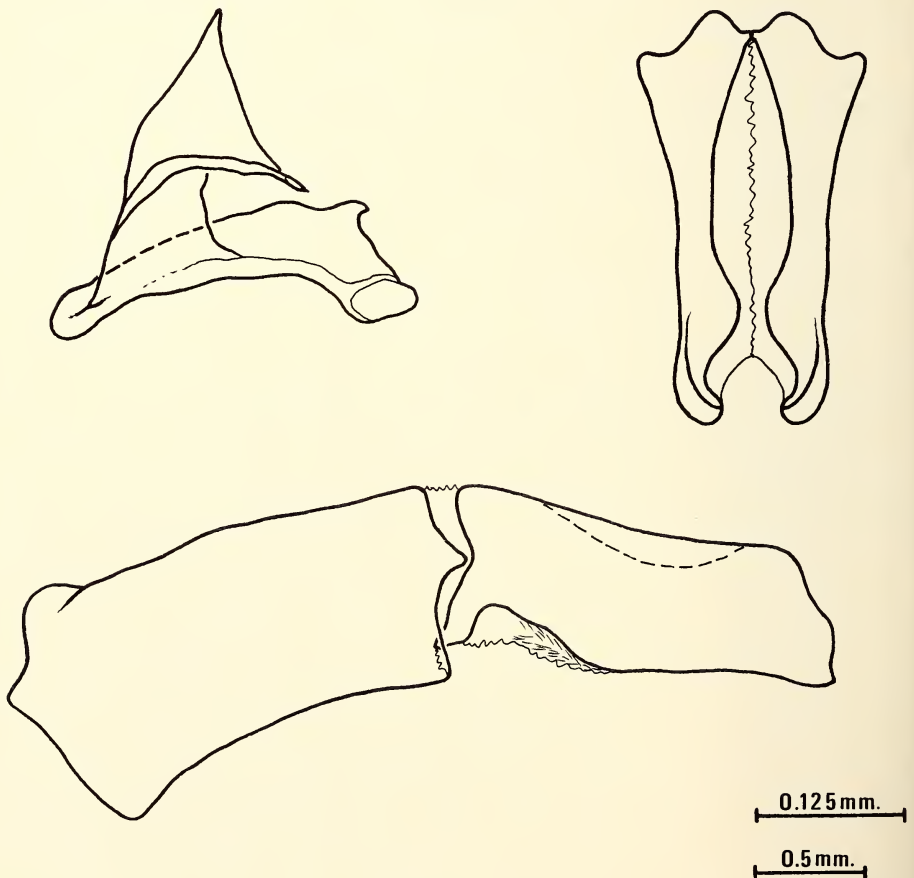


Fig. 8: Male genitalia and copulatrix lamina of *Ch. fuscifer* (Rossi).



Copulatrix lamina characterized by a wide laminar base, almost flat, which supports, and is almost completely covered by, a rather well-developed tectum. Said tectum has a spatial outline similar to a riding saddle. Its posterior region is strongly elevated and ends in a very pronounced, rounded vertex. The fore region is slightly elevated in the form of a weak lip which runs the length of the transversal profile. The lateral external region adopts the form of a dihedral angle in some specimens.

Female Genitalia (fig. 9):

Genital plate in form of an irregular parallelepiped. Two deep, characteristic folds of variable length converge towards, and flank, the genital opening. Glabrous and large paranal sclerites. Spermatheca circular or slightly parabolic. Basal area not wider than the rest of the spermatheca; internal wall thick. Flexions's area reduced. Apical region thin. Apex ends in a prominent projection, its distal wall having a finger or even bifid shape.

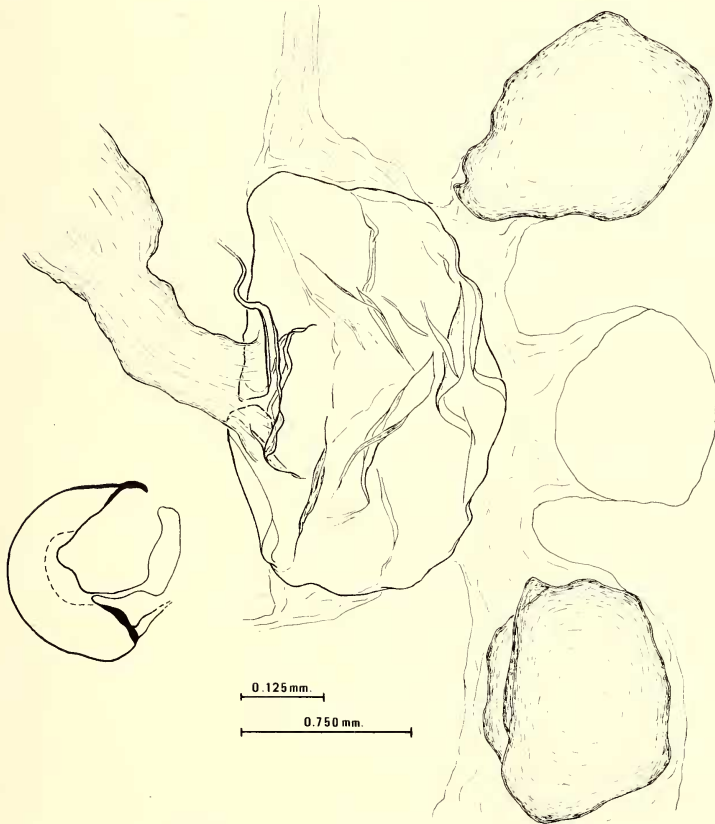


Fig. 9: Female genitalia and spermatheca of *Ch. furcifer* (Rossi).

### Geographic Distribution:

Circummediterranean element. Its area of distribution extends throughout the whole Palearctic Africa from old Spanish Sahara (Rio de Oro) and Ifni through the Moghrebian country, Cirenaica and lowland Egypt, and reaches the Near East (Syria) (LANSBERGE, 1875; REITTER, 1893; JANSSENS, 1937 and BALTHASAR, 1963) and some islands of Eastern Mediterranean: Lesbos (SAHLBERG, 1913). Likewise, this species colonizes a large area of the southeastern mediterranean Europe: European Turkey, Bulgaria, Greece (Makhedonia), Albania, Yugoslavia and Italy to the South of Emilia (PORTA, 1932). In the Western Mediterranean it is found in Sicily, Sardinia, Balearic Islands of Mallorca and Minorca (CARDONA, 1872; BAGUENA, 1967; COMPTE, 1967) and Southwest coast of the Iberian Peninsula (Cádiz), where the only Spanish specimen that I know comes from, which is the same cited by BAGUENA (1967): Algeciras. This species was cited also from Barcelona (LA FUENTE, 1926) and Levante (BAGUENA, 1967).

### Studied Material:

Algeria: Argelia without any other indication, 2♂ 1♀ (MNCN); Saint-Charles 1♀ (MNCN); Tlemcen, 1♂ (MNCN); Spain: Algeciras (Cádiz), 1♀ (MNCN); Ceuta, 3♂ 2♀ (MNCN); Melilla, VI-1909, Arias leg., 2♂ (MNCN); Ain Aguisgal (Ifni), VI-1934, F. Escalera leg., 1♂ 1♀ (MNCN); Sidi Ifni (Ifni), VI-1934, F. Escalera leg., 1♂ 1♀ (MNCN); Tisla, Rio de Oro (Old Spanish Sahara), 26/30-XI-1913, Giner Mary leg., 1♂ (MNCN). Italy: Avetrana (Puglia), 7-VIII-1969, G. Salamanna leg., 1♂ (MZ); Florencia (Toscana), 2♀ (MNCN); Chilivani (Sardinia), 11-VI-1969, 1♂ (MZ); Stintino (Sardinia), 3♂ 6♀ (MZ); Tempio Pausania (Sardinia), VII-1976, M. Zunino leg., 1♂ (MZ). Morocco: Amismiz (Atlas), Escalera leg., 1♂ (MNCN); Atlas O'Nfis, VII-1907, Escalera leg., 1♀ (MNCN); Mazagan, (1♀: VI-1907), Escalera leg., 1♂ 1♀ (MNCN); Marrakesch, III-1907, Escalera leg., 2♂ 1♀ (MNCN); Oudja, Le Boul leg., 1♂ (MNCN); Tanger, Escalera leg., 6♂ 6♀ (MNCN); Tetuán, 2♀ (MNCN). Tunisia: Teboursouk, 1♀ (MNCN). Yugoslavia: Scutari, 2♂ 2♀ (MNCN).

*Ch. klapperichi*: Afghanistan: Oruzgan Gezab, 1300 m. 10-VI-1970 Kabakov leg. et det., 1♂ 1♀ (MNHU).

### *Chironitis haroldi* (BALLION, 1870)

*Onitis haroldi* BALLION, Bull. Soc. Nat. Moscou, 43, 1870 (3): 331.

*Chironitis luctuosus* LANSBERGE, Ann. Soc. Ent. Belg., 18, 1875: 20-21.

*Chironitis haroldi* (BALL.) Bedel, Abeille, 27, 1892: 252-279.

*Chironitis rotundicoxis* REITTER, Bestimm. Tab., 24, 1893: 219.

### External Morphology:

LANSBERGE, 1875; JANSSENS, 1937 and BALTHASAR, 1963.

### Male Genitalia (fig. 10):

Parameres and phallobase of approximately equal length. Apex slightly triangular, quite blunt; its internal side feebly but clearly concave. With a dorsal lobe larger than the

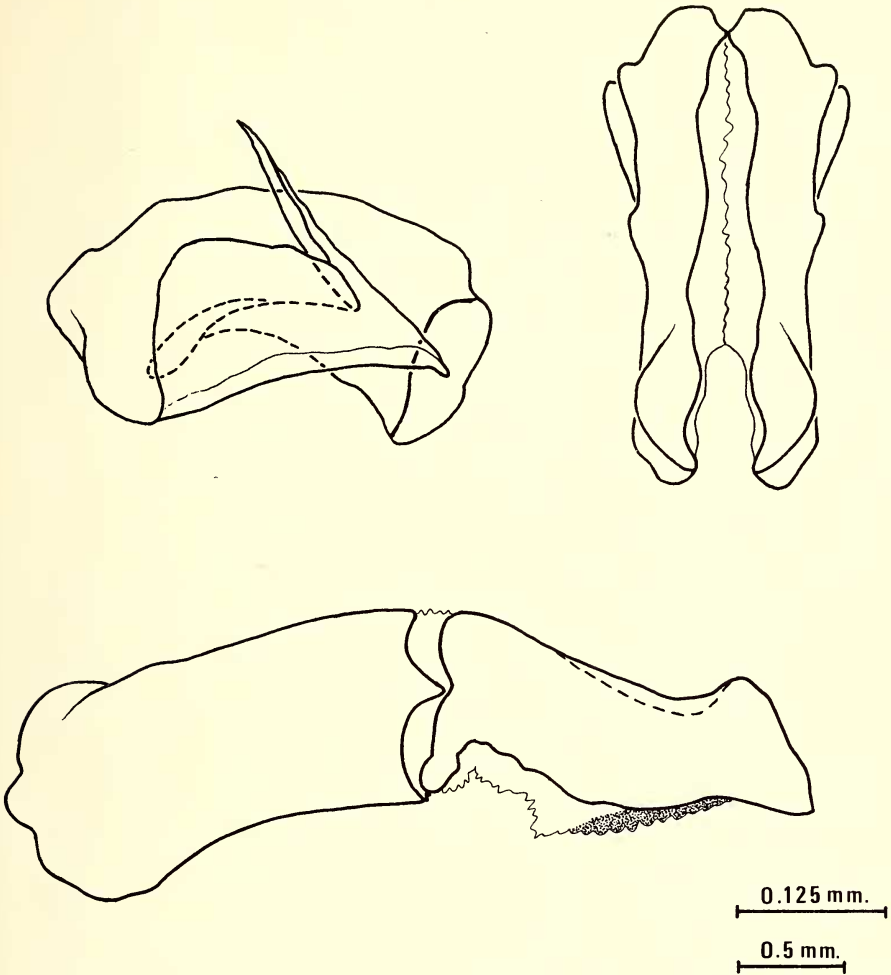


Fig. 10: Male genitalia and copulatrix lamina of *Ch. baroldi* (Ball.).

external side of the paramere, and extending over approximately one third of its apical portion. The basal portion of the membranous area of the parameres is partially sclerotized.

Copulatrix lamina very complex, characterized by a wide laminar and convex base, which supports an extraordinarily developed tectum, which forms a marked dihedral angle.

Female Genitalia (fig. 11):

Genital plate subtriangular. Genital opening flanked by two small convergent folds. Proximal tract of ductus receptaculi dilated, and occasionally bulbous shaped. Small, gla-

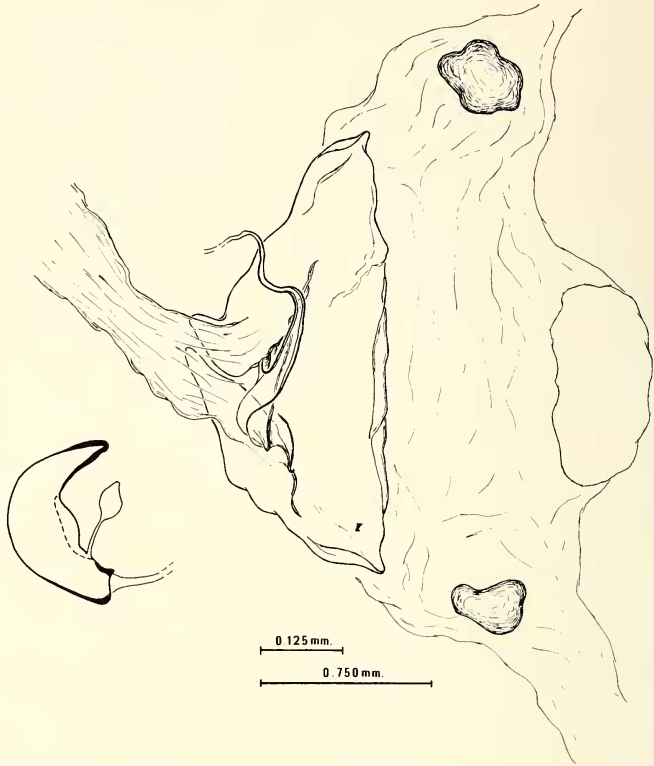


Fig. 11: Female genitalia and spermatheca of *Ch. baroldi* (Ball.).

brous paranal sclerites. Spermatheca parabolic. Area of flexion very small; its narrow basal portion slightly bulbous, with thick walls. Apical portion gradually narrows towards the apex, which has thick walls and is blunt and without external projection.

#### Geographic Distribution:

Eastern-Mediterranean element. In fact, the area of distribution of *Ch. baroldi* extends from the Eastern Mediterranean (Cyprus) across the Turanic area (North of Iran and Afghanistan; Soviet Asia: Caucasus, Transcaspiian and Uzbekistan – see JANSSENS, 1937 and BALTHASAR, 1963 –) until the South slope of Tarbagatay Mountains in the East of Kazakhstan.

#### Studied Material:

U.S.S.R.: Environs of Urdzhar, Tarbagatay Mountains, 24-VI-1967, Nikolayev leg., 1 ♂ 1 ♀ (MZAC); Dzhar-Kurgan, Uzbekistan, Nikolayev leg., 1 ♂ (MZAC); Turkistan, Reitter leg., 1 ♂ 1 ♀ (MNCN).

**Chironitis hauseri** REITTER, 1893

*Chironitis Hauseri* REITTER, Bestimm. Tab., 24, 1893: 221.

## External Morphology:

REITTER, 1893; JANSSENS, 1937 and BALTHASAR, 1963.

## Male Genitalia (fig. 12):

Parameres and phallobase of almost equal length. Apex convergent towards the sagittal axis and with a net concavity in its internal side, giving them a "pincers" shape. Co-

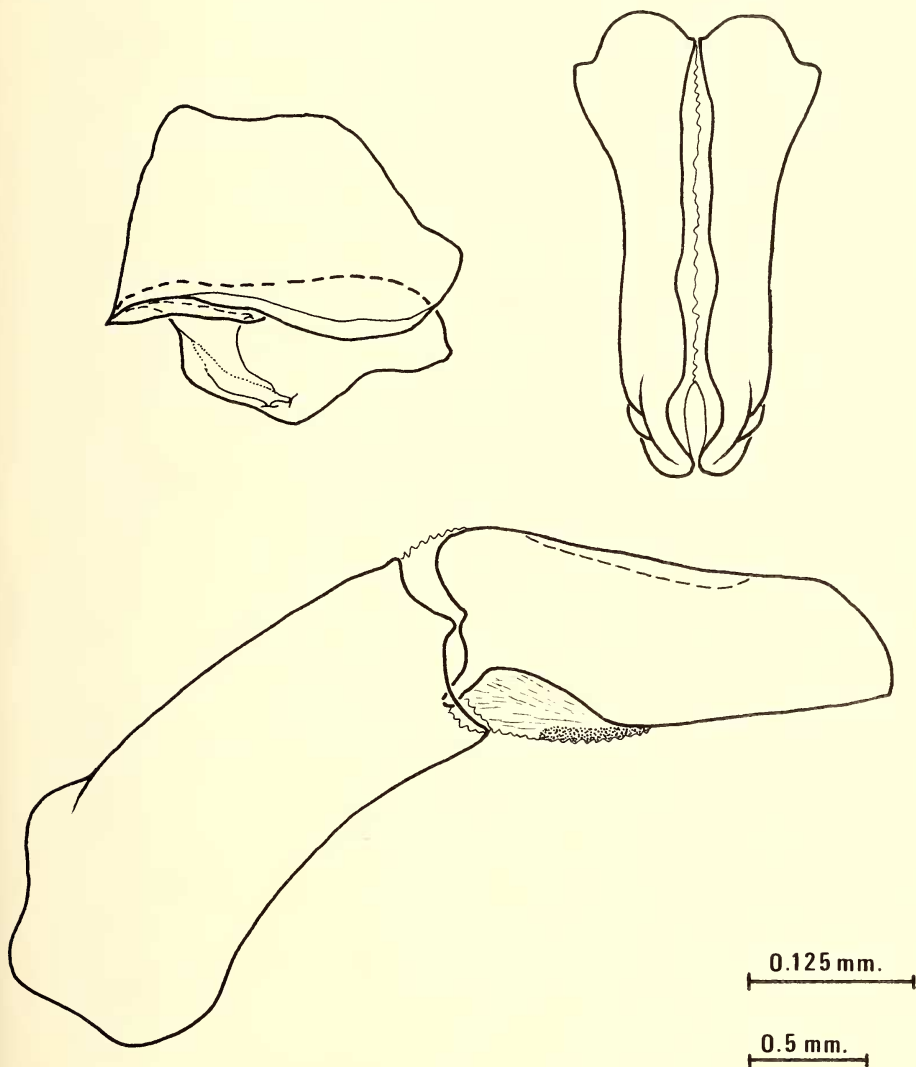


Fig. 12: Male genitalia and copulatrix lamina of *Cb. hauseri* Reitt.

pulatrix lamina with a wide concave tectum as a consequence of its pronounced apical elevation in the form of a wide cuadrangular lamina and a feeble lip rising in its anterior region. Its spatial disposition is very similar to that of a riding saddle. A wide apophysis rising from the lateral internal region of the base of the copulatrix lamina joins it to the tectum.

Female Genitalia (fig. 13):

Genital plate subelliptic, little sclerotized, with a characteristic genital fold and two roughly triangular expansions which flank the genital opening. Large glabrous paranal sclerites. Spermatheca elliptic. The basal region slightly bulbous and internal wall thick. Inconspicuous insertion of the ductus receptaculi. Area of flexion very small. Blunt, slightly narrowed, not very thick walled.

Geographic Distribution:

*Ch. hauseri* was described from the Turkestan: Dschan-Bulak. We do not know later citations which would add new data about its distribution.

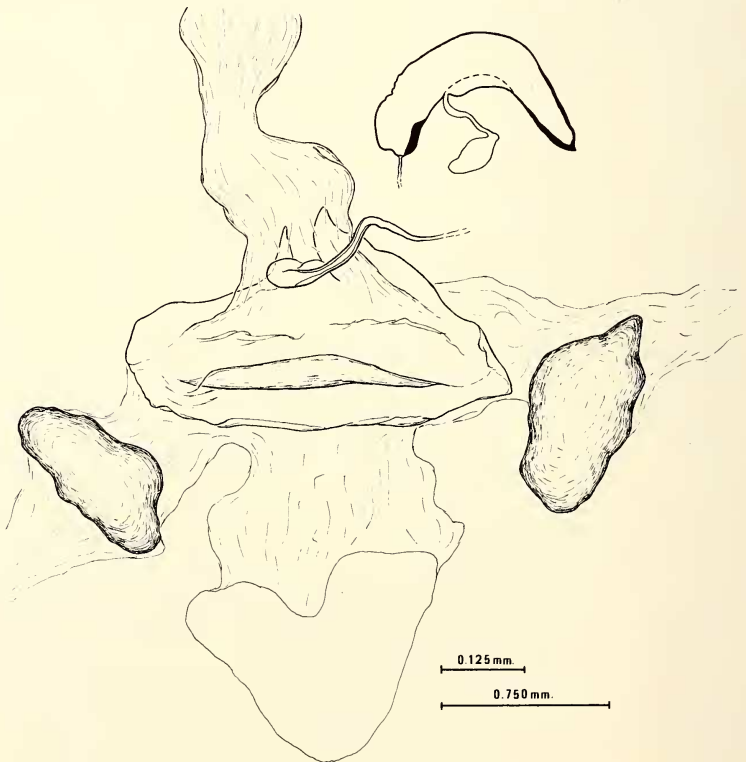


Fig. 13: Female genitalia and spermatheca of *Ch. hauseri* Reitt.



## Studied Material:

Turkmen, REITTER leg., 1 ♂ 1 ♀ (MHNH).

**Chironitis hungaricus** (HERBST, 1789)

*Scarabaeus hungaricus* HERBST, Käfer, II, 1789, 16(4): 230

*Scarabaeus clinias* F., Ent. Syst., 1, 1792: 19

*Onitis amyntas* STEV., Mem. Soc. Nat. Moscou, I, 1806, 10(6): 165.

*Onitis clinias* F., Cast., Hist. Nat. Col., 2, 1840: 49

*Onitis alexis* MULSANT, Coléopt. Fr. Lamell., 1842: 88

*Onitis melibaeus* MULSANT, loc. cit., 88

*Onitis tityrus* MULSANT, loc. cit., 88

*Chironitis hungaricus* LANSBERGE, Ann. Soc. Ent. Belg. 18, 1875: 21, 38–40.

## External Morphology:

LANSBERGE, 1875; JANSSENS, 1937 and BALTHASAR, 1963

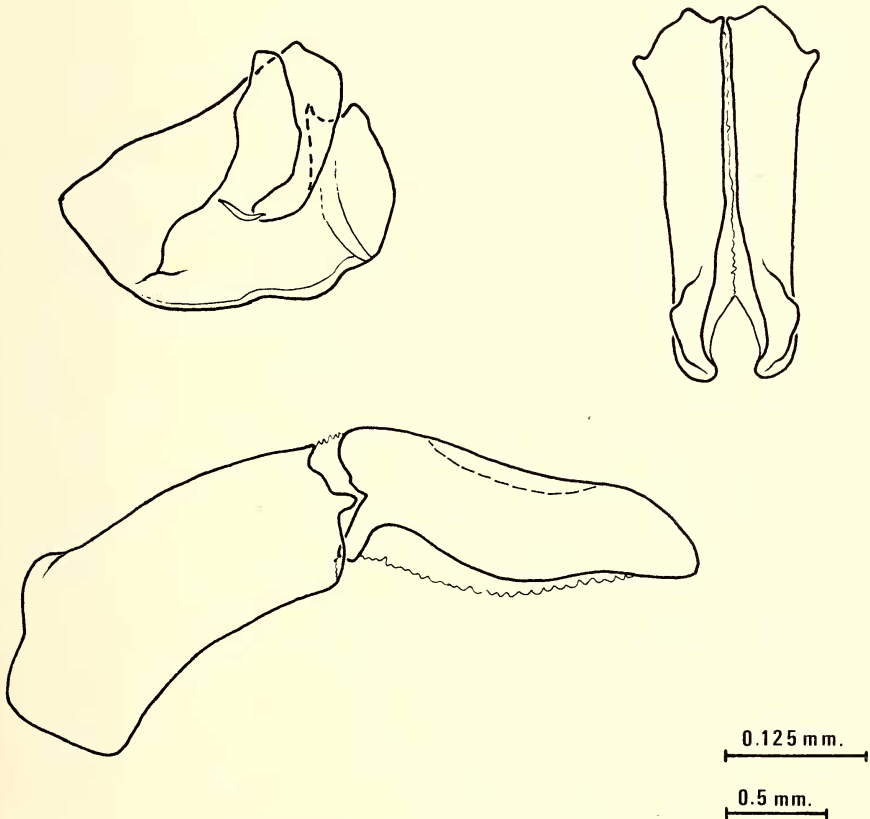


Fig. 14: Male genitalia and copulatrix lamina of *Ch. hungaricus* (Herb.).

## Male Genitalia (fig. 14):

Parameres and phallobase almost of equal length. Apex in form of a not very pronounced pincer; slightly concave lateral internal side; the apex (of blunt vertex) converges towards the sagittal axis. With a not very big sinuated lobe which extends along the apical third of the parameres. Copulatrix lamina characterized by a wide laminar base, convex on its dorsal side. Its external region shows a concavity as a consequence of the partition of its lateral external margin into two lobes, one dorsal, which is a direct continuation of the ventral region of the tectum; the ventral one runs along the external border of the lamina. Both are internally joined. The tectum usually shows a moderate development, with a sharp vertex and a small slightly raised anterior lip.

## Female Genitalia (fig. 15):

Genital plate subtriangular or subcuadrangular and very irregular, with two (or exceptionally more) folds of short axial length, flanking the genital opening. Hirsute paranal sclerites. Spermatheca with bulbous base. Area of flexion very small. Apical portion gradually narrowed towards the apex, which is blunt and with rather thick walls.

## Geographic Distribution:

Euronorthern-mediterranean element: Iberian Peninsula, South of France (PAULIAN & BARAUD, 1982), North of Italy (PORTA, 1932), Yugoslavia, Greece (Thessalia), Euro-

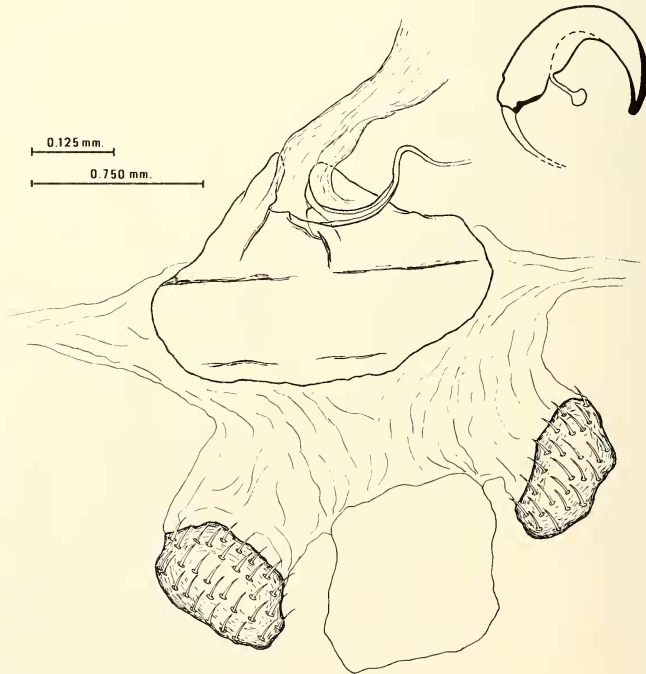


Fig. 15: Female genitalia and spermatheca of *Ch. hungaricus* (Herb.).

pean Turkey (MIKSIC, 1953) until South of European U. S. S. R.: Krym, Ukraine and Podolye (HORION, 1956). The citation of Asia Minor (BALTHASAR, 1963) lacks reliability.™  
*Ch. hungaricus* also goes into inner Europe: Hungary (where it was described), Austria and Czechoslovakia (HORION, op. cit. and MATCHATSCHKE, 1969).

#### Studied Material:

Typical series: Lectotype ♂ (MNHU) with the following labels: I) white manuscript: Europa mer. Nr. 26776; II) white, printed: Zool. Mus. Berlin; III) red, manuscript: *Chironitis hungaricus* HERBST, Lectotypus ♂ F. M. Piera det., 1986; IV) white, manuscript: *Chironitis hungaricus hungaricus* (HERBST), F. M. Piera det., 1986. Paralectotype Nr. 1 ♀ (MNHU) with the following labels: I) white, printed: 26776; II) white, manuscript: *hungaricus*; III) red, manuscript: *Chironitis hungaricus* Paralectotypus No 1 ♂, F. M. Piera det., 1986; IV) white, manuscript as Lectotype. Paralectotypes No 2 to 9 labeled as No 1. No 2: ♀; No 3: ♂; No 4: ♂; No 5: ♀; No 6: ♂; No 7: ♀; No 8: ♀ and No 9: ♂. All kept in collection MNHU.

Hungary: Hungary without any other indication, 2 ♂ 2 ♀ (MNCN); Szigetmonostor, 30-VII-1954, L. Vas-Borosleg., 1 ♂ (MHNH); idem, 16-VII-1961, S. Endrodi leg., 1 ♀ (MHNH). Spain: Riopar (Albacete), 26-VII-1980, J. L. Lencina leg., 1 ♀ (JILC); Almeria without any other indication, VII Mendizábal leg., 1 ♂ (MNCN); Bohoyo (Avila), 1 ♂ (MNCN); El Barco de Avila (Avila), VII-1954 1 ♀ (MNCN); Gredos (Avila), J. Ardois leg., 7 ♂ 3 ♀ (MNCN); Navalperal (Avila), VII-1904, Escalera leg., 1 ♀ (MNCN); Navas del Marqués (Avila), 16-VIII-1978, J. Plaza leg., 1 ♀ (JILC); Calzadilla de los Barros (Badajoz), 26-VII-1974, M. Zunino leg., 1 ♀ (MNCN); Santo Domingo de Silos (Burgos), 3-VII-1973, M. Zunino leg., 1 ♀ (MZ); Environs of Cáceres, 25-VII-1974, M. Zunino leg., 3 ♂ 2 ♀ (MZ); Casar de Palomero (Cáceres) 2/3-VII-1977, F. M. Piera leg., 1 ♀ (MNCN); Guijo de Granadilla (Cáceres), 18-VIII-1980, F. M. Piera leg., 3 ♂ 3 ♀ (MNCN); idem, 30/31-VII-1983 F. M. Piera leg., 1 ♂ 1 ♀ (MNCN); Santibañez el Alto (Cáceres), 25-VIII-1980, F. M. Piera leg., 4 ♂ 2 ♀ (MNCN); Villar de Plasencia (Cáceres), 15-VIII-1979, F. M. Piera leg., 1 ♂ 2 ♀; idem, 6-VIII-1982, F. M. Piera leg., 2 ♀ (MNCN); Puerto Real (Cádiz), Smith leg., 2 ♂ (MNCN); Córdoba without any other indication, 3 ♀ (MNCN); Tragacete (Cuenca), 1 ♀ (MNCN); Alhambra (Granada), 1 ♂ (MNCN); Hospital de Orbigo (León), 26-VII-1973, M. Zunino leg., 2 ♀ (MZ); Arroyomolinos (Madrid), 8, 11 and 29-VII-1980, J. I. L. Colón leg., 9 ♂ 5 ♀ (JILC); idem, 8-VIII-1980, J. I. L. Colón leg., 1 ♀ (JILC); Cercedilla (Madrid), 6-VII-1978, J. I. L. Colón, 1 ♂ 1 ♀ (JILC); Cercedilla (Madrid), J. Lauffer leg., 1 ♀ (MNCN); Cercedilla in El Ventorrillo (Madrid), J. Abajo leg., 2 ♂ 1 ♀ (MNCN); El Escorial (Madrid), 16/17-VII-1974, M. Zunino leg., 1 ♂ 1 ♀ (MNCN); El Escorial (Madrid), VIII-1940, Lauffer leg., 7 ♂ 13 ♀ (MNCN); Madrid without any other indication, 6 ♂ (MNCN); Robledondo (Madrid), 17-VII-1974, M. Zunino leg., 2 ♂ 2 ♀ (MZ); Casafraanca (Salamanca), 24-VIII-1978, J. I. L. Colón leg., 1 ♀ (JILC); Sequeros (Salamanca), VII-1954, 1 ♀ (MNCN); San Rafael (Segovia), J. Ardois leg., 1 ♂ (MNCN); Environs of Segovia, 21-VII-1974, M. Zunino leg., 1 ♀ (MZ); Soria without any other indication, 1 ♀ (MNCN); Olmedo (Valladolid), 1 ♀ (MNCN). South Europe: South Europe without any other indication,

6♂ 5♀ (MNHU). U.S.S.R.: Southern U.S.S.R. without any other indication, 1♂ (MNCN).

### *Chironitis irroratus* (ROSSI, 1790)

*Scarabaeus irroratus* ROSSI, Fauna Etrusca, 1, 1790: 7

*Onitis lophus* FABRICIUS, Suppl. Ent. Syst., 1798: 26

*Scarabaeus moeris* OLIVIER Entom., I Scarab., 1798, 21 (193): 136.

*Onitis calcaratus* OLIVIER, Encycl. méth., 8, 1811 (1812): 490

*Onitis irroratus* (ROSSI), Castelnau, Hist. Nat. Col., 2, 1840: 90

*Onitis inversus* COSTA, Fauna Napoli, Coleott., 1853, Addiz.: 1

*Chironitis irroratus* (ROSSI) Lansberge, Ann. Soc. Ent. Belg., 18, 1875: 21, 34 and 43.

#### External Morphology:

LANSBERGE, 1875; JANSSENS, 1937 and BALTHASAR, 1963.

#### Male Genitalia (fig. 16):

The male genitalia of *Ch. irroratus* and *Ch. hungaricus* are not very different, except for small anatomical details which are commented on in the following:

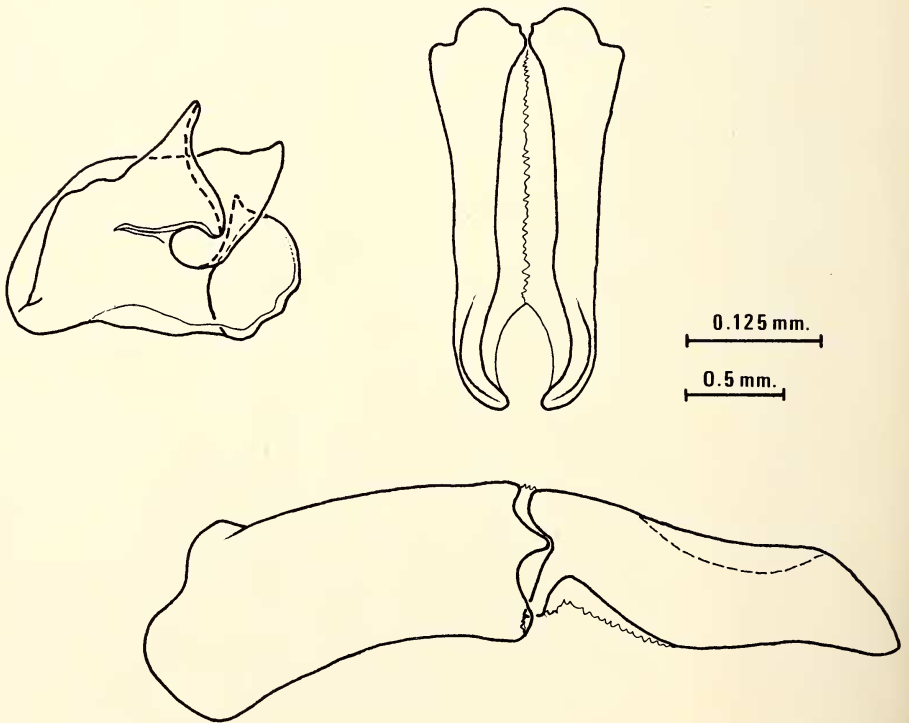


Fig. 16: Male genitalia and copulatrix lamina of *Ch. irroratus* (Rossi).

With respect to the apex of parameres, I must point out that the internal concavity is more pronounced in *Ch. irroratus*, thus giving rise to stronger "pincers" than in *Ch. hungaricus* (compare figs. 14 and 16). With respect to the copulatrix lamina, the model of development and spatial configuration of *Ch. irroratus* is very similar to that of the tectum. In fact, the lateral development in *Ch. irroratus* gives rise to a feeble dihedral angle.

Female Genitalia (fig. 17):

Not appreciably different from *Ch. hungaricus*.

Geographic Distribution:

This taxon has a Southern mediterranean distribution, reaching the South of Western Mediterranean Europe.

Moghrebian Africa: Morocco (except in Saharian regions – KOCHER, 1958 –) and Algeria; Islands of the Western Mediterranean: cited imprecisely in the Balearic Islands by LA FUENTE (1926) and in Mallorca by BAGUENA (1967), Corsica, Sardinia, Eolie Islands and Sicily (PORTA, 1932 and BARAUD, 1977). According to PORTA (op. cit.) *Ch. irroratus* in Italy reaches Toscana. From the Iberian Peninsula, I know of only two specimens (♂), quoted by BAGUENA (op. cit.), labeled Cartagena (Murcia) and Madrid respectively. However, it has been cited at a later date in all the South of the Iberian Peninsula (from Almería to Cádiz) and the South of Portugal (BARAUD, 1977).

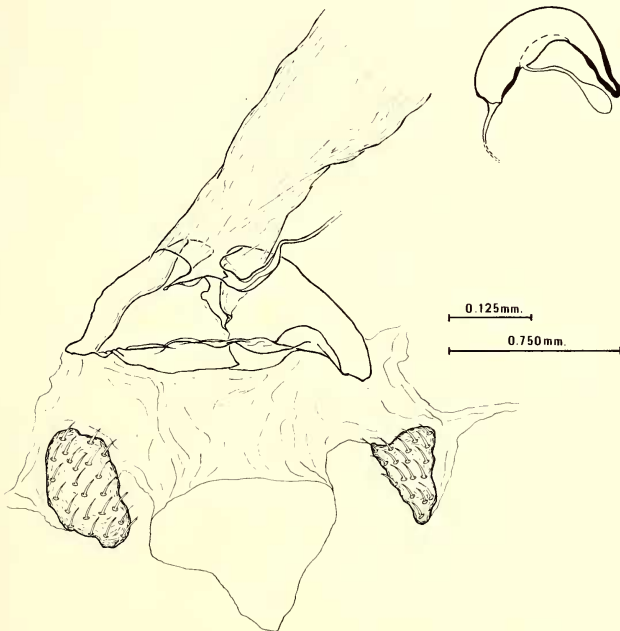


Fig. 17: Female genitalia and spermatheca of *Ch. irroratus* (Rossi).

Likewise, according to SCHATZMAYR (1946, p. 50), *Ch. irroratus* colonizes lowland Egypt and the Sinai Peninsula reaching Syria as an Eastern limit.

#### Studied Material:

Typical series: Lectotype ♂ (MNHU) with the following labels: I) white, printed: 26774. II) white, manuscript: *irroratus* ROSSI Europa meridional; III) white, printed: Zool. Mus. Berlin. IV) white, manuscript: *Clinias* FAB., *Sc. hungaricus*; *irroratus* R., *SC. moeris* OL.?, Hung. Ital. Lus. Gall.; V) red, manuscript: *Chironitis irroratus* ROSSI Lectotypus ♂ F. M. Piera det., 1986; VI) white, manuscript: *Chironitis hungaricus irroratus* (ROSSI), F. M. Piera det., 1986. Paralectotype No 1 ♀ (MNHU) with the following labels: I) white, manuscript: Europa mer., Nr. 26774; II) white, printed: Zool. Mus. Berlin; III) red, manuscript: *Chironitis irroratus* ROSSI, Paralectotypus No 1 ♀, F. M. Piera det., 1986; IV) white, manuscript: *Chironitis hungaricus irroratus* (ROSSI F. M. Piera det., 1986. Paralectotypes No 2 to 7, No. 7: ♂. All kept in collection MNHU.

Algeria: Argel, Pérez Arcas leg., 3 ♂ (MNCN); Mascara, 1 ♀ (MNCN); Saint-Charles, 2 ♀ (MNCN). France: Gradello (Corsica), 8-VII-1970, O. Elter leg., 6 ♂ 3 ♀ (MZ); Lento (Corsica), 14-VI-1976, A. Paulian leg., 1 ♂ (MNCN); Ozani (Corsica), 11-VII-1970, O. Elter leg., 7 ♂ 2 ♀ (MZ). Italy: Chilivani (Sardinia), 11-VI-1963, Franzini leg., 1 ♀ (MZ); Ortola de Irgoli (Sardinia), 14-VIII-1970, O. Elter leg., 5 ♂ 5 ♀ (MZ); Stintino (Sardinia), 1 ♂ 1 ♀ (MZ); Vulcana (Eolie Islands), VII-1971, 1 ♀ (MZ); Avetrana (Puglia), 8-VII-1968, G. Salamana leg., 1 ♂ 1 ♀ (MZ); Florence (Toscana), 1 ♀ (MNCN). Morocco: Atlas O'Nfis, VII-1907, 3 ♂ 6 ♀ (MNCN); Barranco del Lobo Mazuza, 8-IX-1943, Giner Mari leg., 1 ♀ (MNCN); Glaoui, 1 ♀ (MNCN); Ixmoart, Beni Sicar, 23-VIII-1943, Giner Mari leg., 1 ♀ (MNCN); Larache, Escalera and A. Casares leg., 2 ♂ 3 ♀ (MNCN); Mazagán, Escalera leg., 1 ♂ (MNCN); Mogador, (5 ♂ 1 ♀: VII-1905), Escalera leg., 16 ♂ 10 ♀ (MNCN); Muley Ali, Ulad Setut, 28-VIII-1943, Giner Mari leg., 2 ♂ 4 ♀ (MNCN); Oudja, Le Boul leg., 1 ♀ (MNCN); Sus, Escalera leg., 1 ♀ (MNCN); Tanger, M. Escalera leg., 2 ♂ (MNCN). Palestine: Sarepta (Galilee), 1 ♀ (MNCN). Spain: Ceuta, 1 ♂ (MNCN); Madrid without any other indication, 1 ♂ (MNCN); Cartagena (Murcia), 1 ♂ (MNCN). Syria: Syria-Libanon without any other indication, 1 ♂ (MNCN). South Europe: South Europe without any other indication, 5 ♂ 3 ♀ (MNHU).

#### *Chironitis moeris* (PALLAS, 1781)

*Scarabaeus moeris* PALLAS, Icones Ins., 1781 (2): 3, T. A.

*Onitis moeris* (PALLAS) Oliv., Encycl. méth., 8, 1811 (1812): 490.

*Onitis sophax* FISCHER, Bull. Soc. Nat. Moscou, 2, 1830: 186.

*Chironitis moeris* (PALLAS) Lansberge, Ann. Soc. Ent. Belg., 18, 1875.

#### External Morphology:

LANSBERGE, 1875; JANSSENS, 1937 and BALTHASAR, 1963.



## Male Genitalia (fig. 18):

Parameres / Phallose: 1/1. Apex of the parameres of astrong "pincers" shape, as a consequence of a deep sinus of the internal side. Mentioned side shows a second but shallower, but equally conspicuous concavity at the level of the medial region. The narrow lobe of the dorsal apical region follows the profile of the paramere from the apex to the process which separates the two sinuses of the paramere's internal side. In lateral view the profound dorsal concavity of the parameres clearly separates the apical half from the basal half. Wide laminar base of copulatrix lamina very convex with its anterior region raised in a narrow lip, which towards the lateral external region, gives rise to a small tectum. Concavity in said region is consequence of the overlapping of dorsal and ventral lobes.

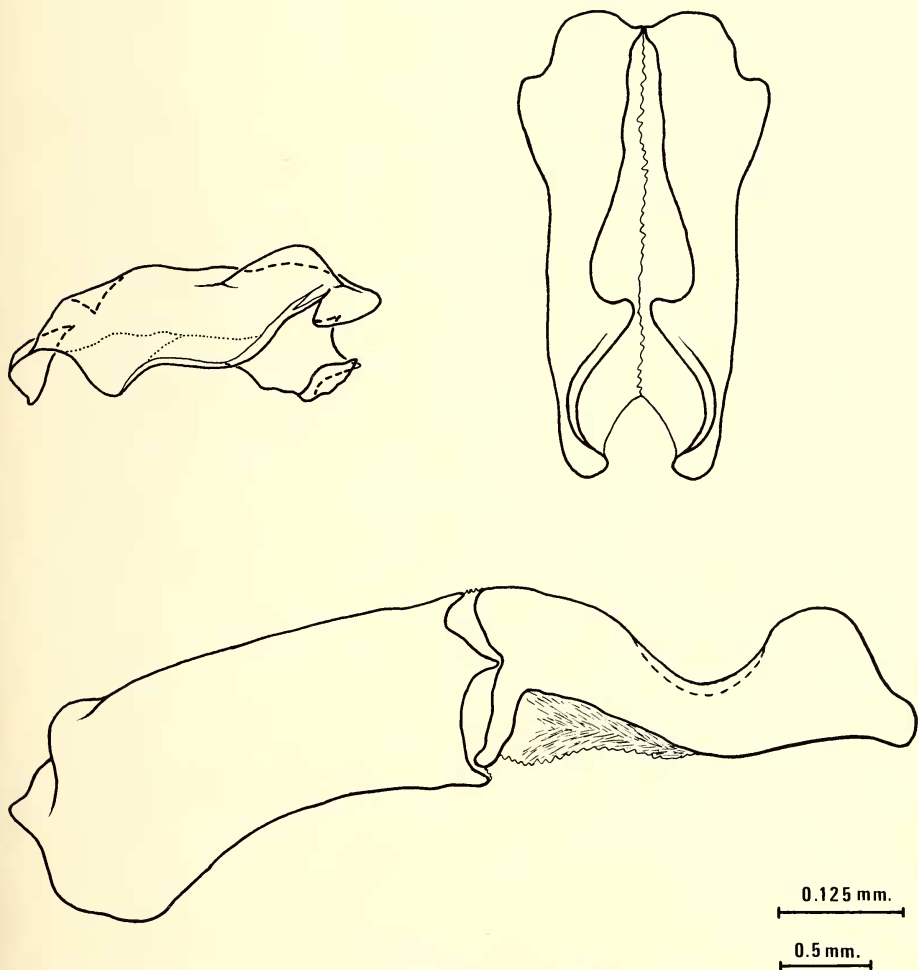


Fig. 18: Male genitalia and copulatrix lamina of *Cb. moeris* (Pallas).

The apical portion of the ventral lobe gives rise to a small secondary lobe, while in the posterior region of the dorsal lobe there is a roughly triangular protuberance.

Female Genitalia (fig. 19):

Genital plate almost rectangular, with two folds more or less sinuous and convergent towards the genital opening. Large glabrous paranal sclerites. Spermatheca more or less semicircular. Equally wide in all its extension, except in the apical region which gradually narrows towards the slightly finger shaped, thick walled apex. Basal walls also thick. Flexion's area very reduced.

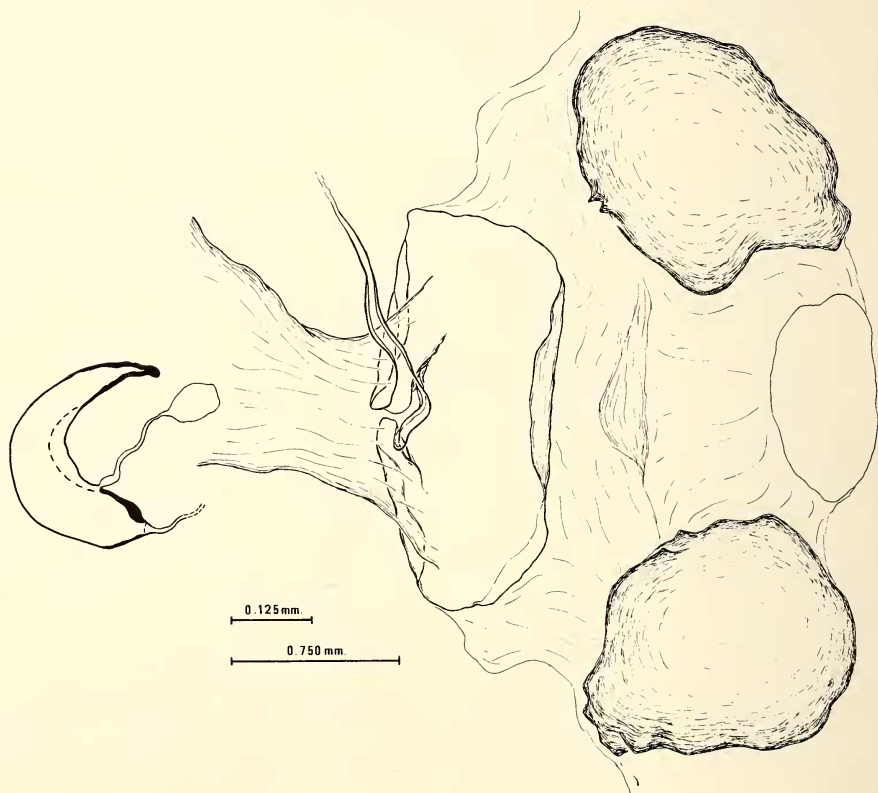


Fig. 19: Female genitalia and spermatheca of *Ch. moeris* (Pallas).

Geographic Distribution:

Syria, Southern U.S.S.R.: Uzbekistan, Turkestan (Bukhara and Samarkand) and Kazakhstan.

Studied Material:

Palestine: Sarepta (Galilee), 1 ♂ (MNCN). Syria: Syria without any other indication, 2 ♀ (MNCN). U.S.S.R.: Samarkand (Turkestan), Splichal leg., 1 ♂ (MNCN).

**Chironitis pamphilus** (MÉNÉTRIES, 1849) *Onitis pamphilus* MÉNÉTRIES, Mem. Acad. Petrop., 1849: 57

*Onitis eumenes* MOTSCHOUJSKY, Bull. Soc. Nat. Moscou, 32, 1859 (2): 59.

*Chironitis ponticus* LANSBERGE, Ann. Soc. Ent. Belg., 18, 1875: 21, 36 and 43.

*Chironitis pamphilus* (MÉNÉTRIES) Reitter, Bestimm. Tab., 24, 1892 (1893): 222.

External Morphology:

LANSBERGE, 1875; JANSSENS, 1937 and BALTHASAR, 1963.

Male Genitalia (fig. 20)

The apical region of the parameres is not appreciably different from that of *Ch. hungaricus* (compare figures). Likewise, the copulatrix lamina fits the anatomical model of

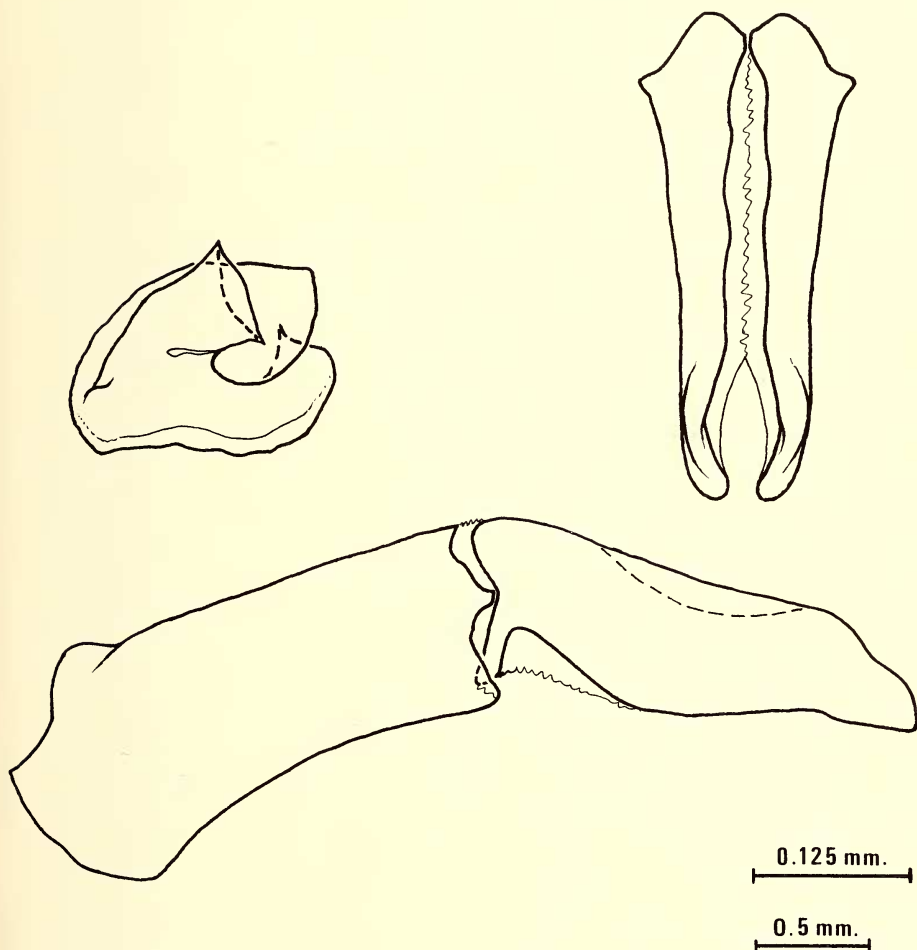


Fig. 20: Male genitalia and copulatrix lamina of *Ch. pamphilus* (Ménétr.).

*Ch. hungaricus* and *Ch. irroratus* and more concretely, we can affirm that except for individual characteristics, it is identical to the latter, and only differs from the former (*Ch. hungaricus*) in the development of the tectum in a dihedral angle.

Female Genitalia (fig. 21):

Not appreciably different from *Ch. hungaricus* and *Ch. irroratus*.

Geographic Distribution:

*Ch. pamphilus* colonizes the Western-mediterranean Asia: Asia Minor, Syria, Lebanon and Palestine and, according to the literature, some enclaves of Southeastern Europe: Thessalia (Greece) and Southern U.S.S.R. (JANSSENS, 1937 and MIKSIC, 1956). Likewise, it is found in Asia in Iran and Afghanistan (BALTHASAR, 1963), with the Transkaspian Region und Uzbekistan forming the Eastern limit of its distribution.

Studied Material:

Iran: Persia, Kermanschach, V-1909, Hauser leg., 1 ♂ 2 ♀ (MNCN). Lebanon: Syria-Lebanon without any other indication, 5 ♂ 6 ♀ (MNCN). Syria: Amanus Mountains, V-1902, Escalera leg., 1 ♀ (MNCN). Turkey: Mersina, A. Kricheldorff leg., 1 ♂ 1 ♀ (MNCN). U.S.S.R.: Djellabad (Transkaspie), 1 ♂ (MNCN); Geox-Tapa

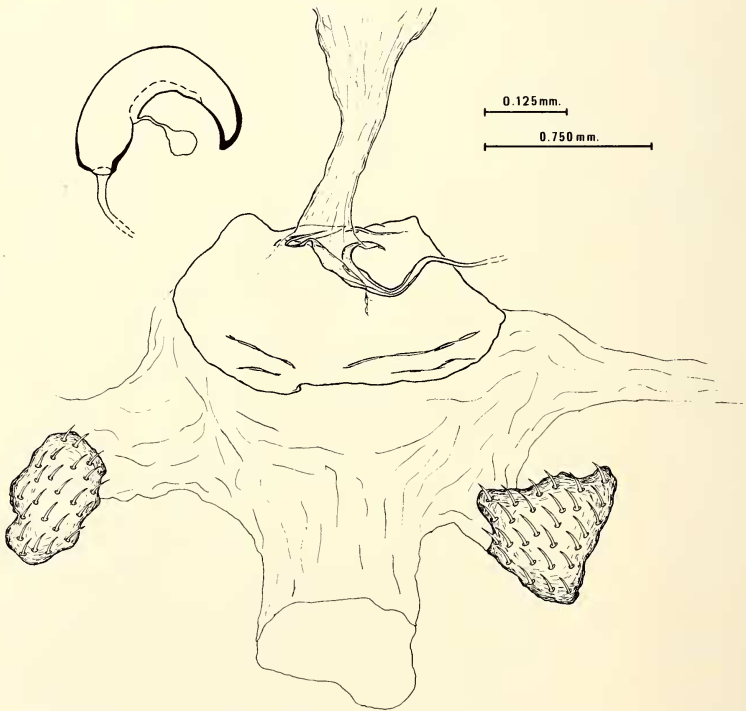


Fig. 21: Female genitalia and spermatheca of *Ch. pamphilus* (Ménétr.).

(Caucasus), 4♂ 1♀ (MNCN); Samarkand (Uzbekistan), 1♀ (MNCN); Southern U.S.S.R. without any other indication, Pérez Arcas leg., 1♂ (MNCN).

**Chironitis phoebus** REITTER, 1893

*Chironitis phoebus* REITTER, Bestimm. Tab., 24, 1892 (1893): 222.

*Chironitis pamphilus* LANSBERGE (nec. MÉNÉTRIÉS), Ann. Soc. Ent. Belg., 18, 1875: 21, 41 and 43.

External Morphology:

LANSBERGE, 1875; JANSSENS, 1937 and BALTHASAR, 1963.

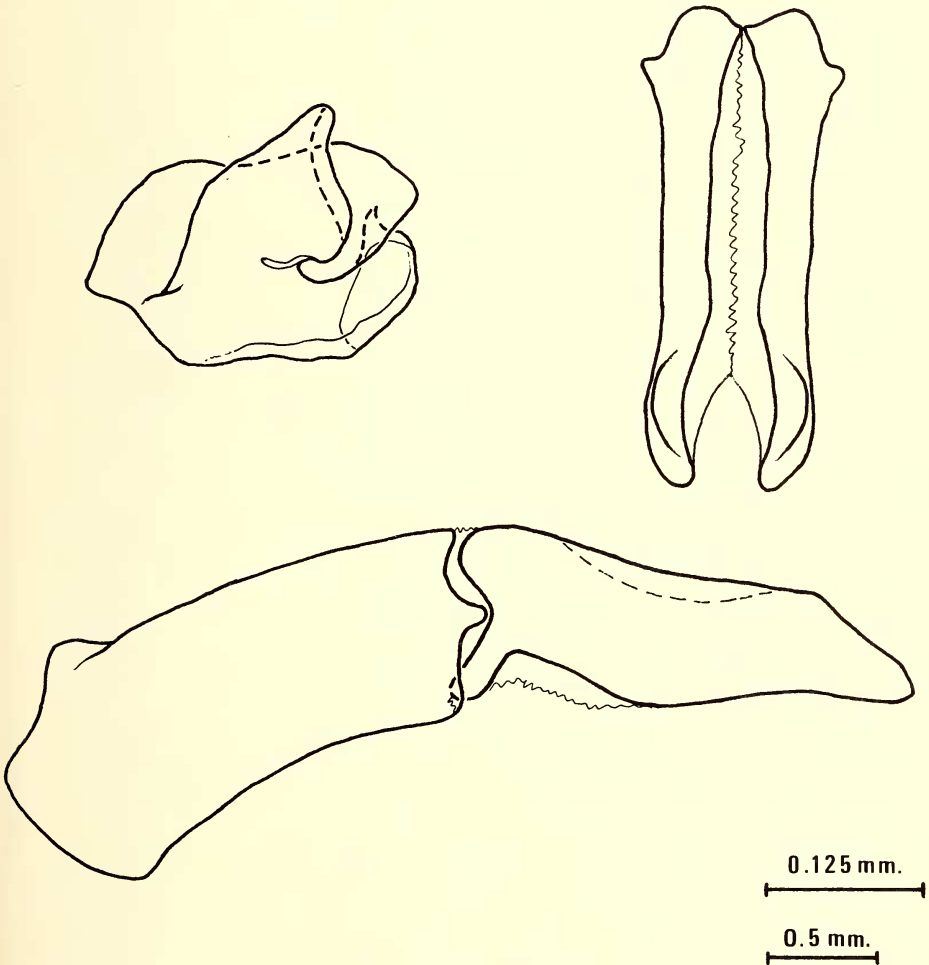


Fig. 22: Male genitalia and copulatrix lamina of *Ch. phoebus* Reitt.

## Male Genitalia (fig. 22):

Not appreciably different from *Ch. pamphilus*. The dihedral angular shape of the *tectum* of *Ch. phoebus* (like that of *Ch. pamphilus* and *Ch. irroratus*) is the only feature differentiating it from *Ch. hungaricus*.

## Female Genitalia (fig. 23):

Not appreciably different from *Ch. hungaricus*, *Ch. pamphilus* and *Ch. irroratus*.

## Geographic Distribution:

*Ch. phoebus* seems to colonize a wide area, from the Ukraine and Caucasus (U.S.S.R.) in the west, (JANSSENS, op. cit. and BALTHASAR, op. cit.), to Eastern Kazakhstan and the present Chinese Turkestan, in the East.

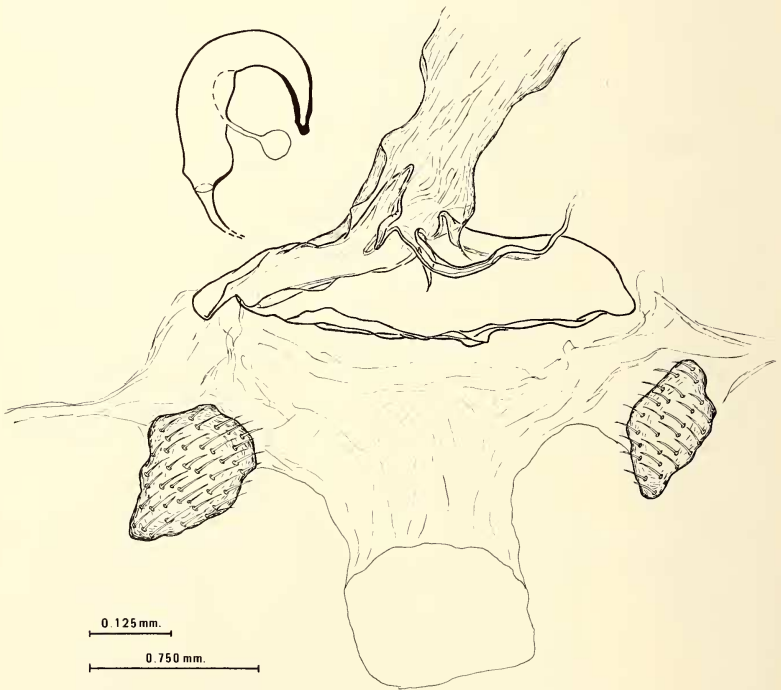


Fig. 23: Female genitalia and spermatheca of *Ch. phoebus* Reitt.

## Studied Material:

China: Kuldscha (Presently Yi-ning), Eastern Turkestan, 2♂ 5♀ (MNCN).  
 U.S.S.R.: Mujun-kum (Akmolinsk), Kricheldorff leg., 2♂ 2♀ (MNCN); environs of Bakanás (Kazakhstan), 11-VII-1969, G. Nikolayev leg., 1♂ 1♀ (MZAC); Southern U.S.S.R. without any other indication, Reitter leg., 1♀ (MNHN).



**Chironitis sterculius** (BALLION, 1870)*Onitis sterculius* BALLION, Boll. Soc. Nat. Moscou, 43, 1870 (3): 331.*Chironitis sterculius* (BALLION) Lansberge, Ann. Soc. Ent. Belg., 18, 1875: 21 and 29.

## External Morphology:

LANSBERGE, 1875; JANSSENS, 1937 and BALTHASAR, 1963.

## Male Genitalia (fig. 24):

Parameres and phallobase of almost equal length. The former of almost constant width except in the apical region, where they are reduced to half by a profound concavity in their external side. The apex converges towards the sagittal axis in such a way that the

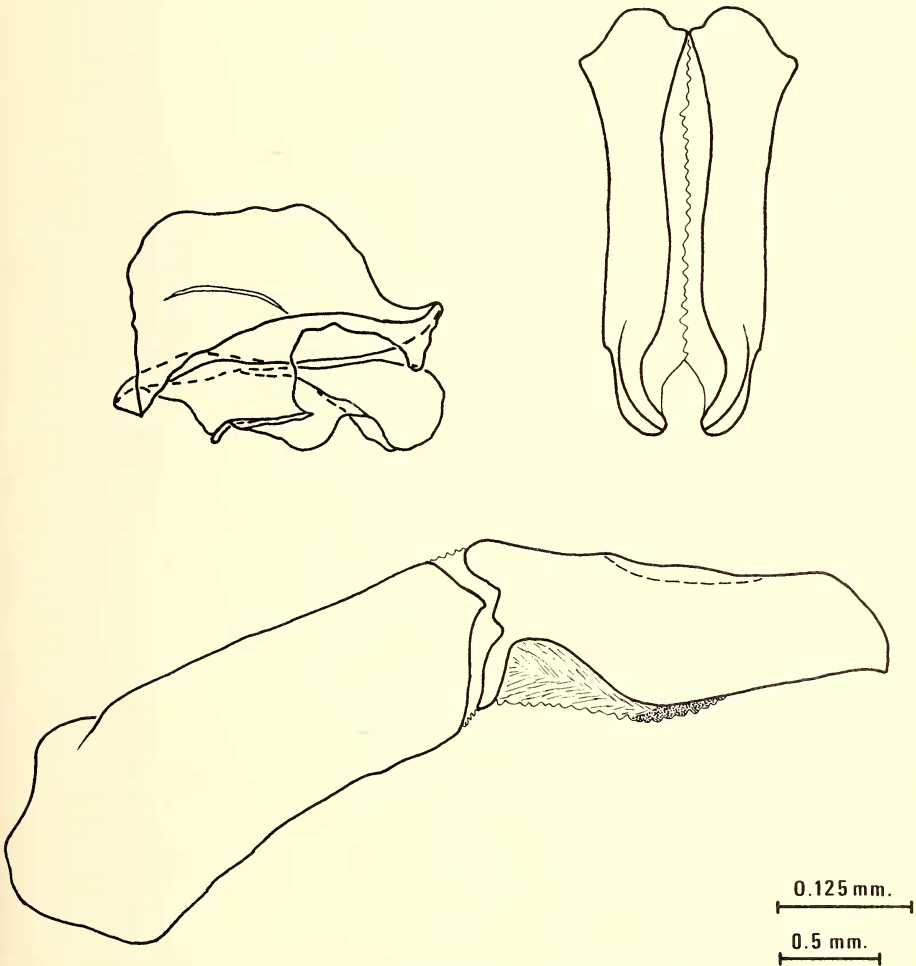


Fig. 24: Male genitalia and copulatrix lamina of *Ch. sterculius* (Ball.).

apical portion has a "pincer" shape. With a dorsal lobe, one fourth as long as the paramere, starting from the apex. Basal portion of the membranous ventral area partially sclerotized. Complex copulatrix lamina characterized by a not very convex base; its surface is undulating and supports a very wide tectum which completely covers its dorsal side. Wide saddle-shaped dorsal concavity in tectum. Wide cuadrangular lamina in tectum's posterior region, and deep sinus in external half of very elevated anterior region.

Female Genitalia (fig. 25):

Longitudinal folds in triangular genital plate delimit a wide genital opening. Not very large glabrous paranal sclerites. Spermatheca wide in its medial region; very small membranous area of flexion. Narrow basal region with thick internal wall. Apical region gradually narrows toward blunt, very thick walled apex with a narrow opening.

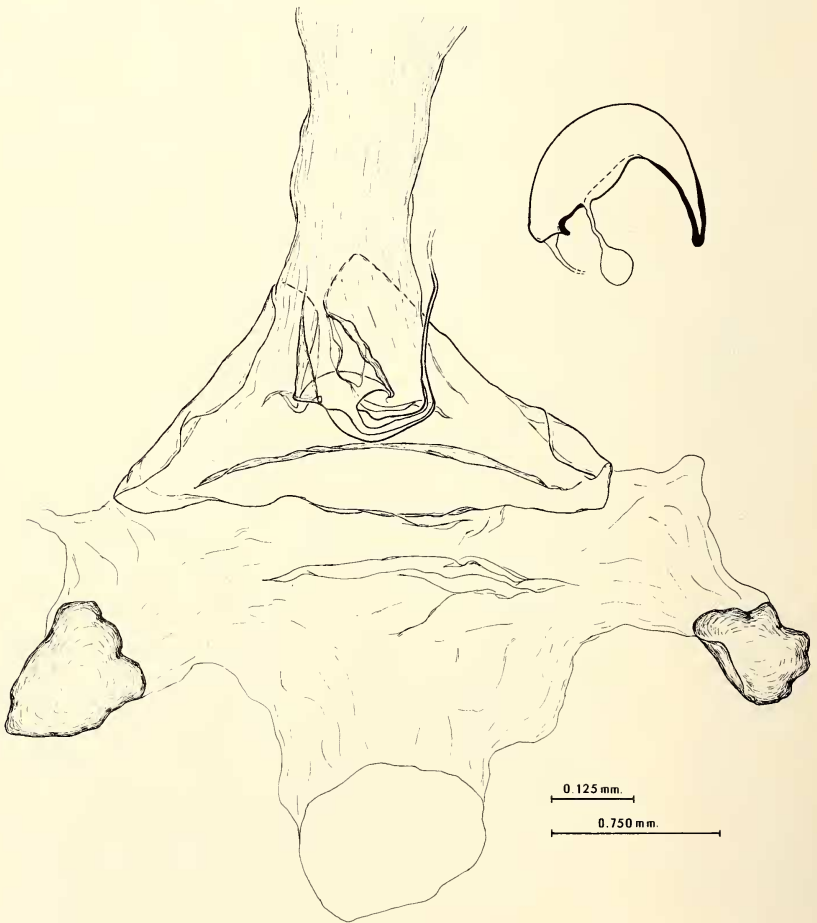


Fig. 25: Female genitalia and spermatheca of *Ch. sterculius* (Ball.).

### Geographic Distribution:

Southern Soviet Asia: Turkestan (Chodskent — JANSSENS, op. cit. and BALTHASAR, op. cit.) and South Kazakhstan.

### Studied Material:

Typical series: Paratype ♂ (MHNH) with the following labels: I) white, printed: Chodshent; II) white, binded in red and manuscript: Paratypus (printed in red) 1870. *Onitis sterculius* BALLION; III) white, manuscript: coll. Reitter.

U.S.S.R.: Northwestern of Kizil-kun (South of Kazakhstan), 2-VI-1961 Nikolayev leg., 1 ♂ 1 ♀ (MZAC).

## B.— Discussion and Taxonomic conclusions

The comparative study of the male and female genitalia of the previously discussed taxa permits one to reach the following conclusions:

1.— There is no doubt about the taxonomical status of the following taxa: *Chironitis candezei* LANSBERGE, 1875; *Ch. furcifer* (ROSSI, 1792); *Ch. haroldi* (BALLION, 1870); *Ch. hauseri* REITTER, 1893; *Ch. moeris* (PALLAS, 1781) and *Ch. sterculius* (BALLION, 1870).

2.— On the contrary, the author is not in agreement with the status the literature generally concedes to *Ch. granulipennis* REITTER, 1909 and *Ch. klapperichi* BALTHASAR, 1956.

With respect to the first, I do not accept the synonymy proposed between *Ch. candezei* and *Ch. granulipennis*. Although the Types of both taxa have been studied, the final conclusion must nevertheless be put off, due to our knowing only one female specimen of both taxa.

With respect to *Ch. klapperichi*, the author thinks that it should be included in the catalogue of synonymies of *Ch. furcifer*, even though its apparent geographic isolation (Afghanistan), would lead one to suppose that it is a subspecies of this latter.

3.— Likewise, *Ch. hungaricus* (HERBST, 1789), *Ch. irroratus* (ROSSI, 1790), *Ch. pamphilus* (MENÉTRIES, 1849) and *Ch. phoebus* REITTER, 1893, constitute a rather more complex taxonomic conjunct of which a more detailed examination is necessary, taking into account the genital characters:

4.— In agreement with the third point, we can affirm that the genitalia of both sexes of *Ch. irroratus*, *Ch. pamphilus* and *Ch. phoebus* are not significantly different (see figures and taxonomic descriptions). This leads us to conclude that we are dealing with one and the same taxon, which from the nomenclatural point of view should take the name: *Chironitis irroratus*.

These three taxa have been described as different species, from considerations of some external morphological differences in the process of the fore and hind femora, in the

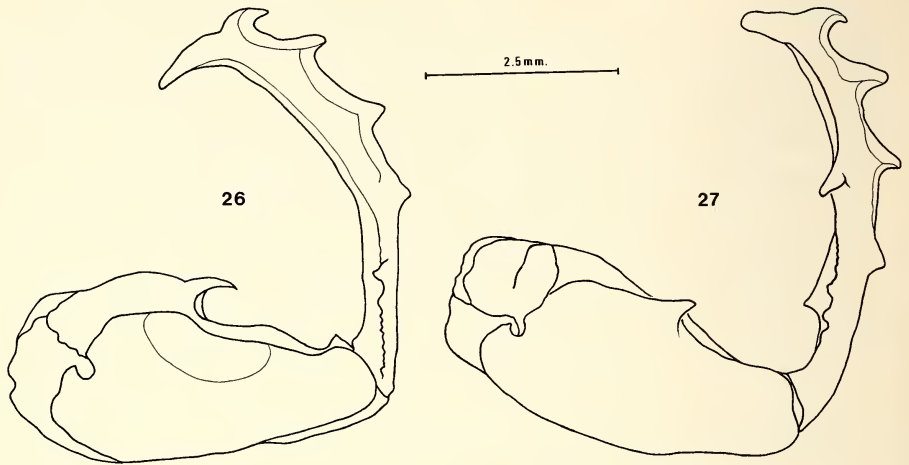


Fig. 26 and 27: Fore legs of *Ch. hungaricus* and *Ch. irroratus*. Fig. 26: *Ch. hungaricus*; fig. 27: *Ch. irroratus*.

middle and fore tibiae, in the metasternum and in the middle coxae (see LANSBERGE, 1875; JANSSENS, 1937 and BALTHASAR, 1963). All these morphological differences should be understood as expressions of different phenotypes (polymorphisme) within different populations of a polytypic species (see ahead conclusion no. 5).

The geographic distribution of said taxa populations (fig. 36) shows a gradual substitution of one for other in a West – East direction and, consequently, a gradient of phenotypic variation (in this direction) which may be observed in the following male characters:

West	—————	East
<i>Ch. irroratus</i> (Mediterranean populations)	<i>Ch. pamphilus</i> (Western-asiatic populations)	<i>Ch. phoebus</i> (Central-asiatic populations)

i) In the fore femur: reduction of the thorn of the antero-inferior hull and parallelly, development of the tooth of the antero-superior hull (figs. 27, 30 and 33).

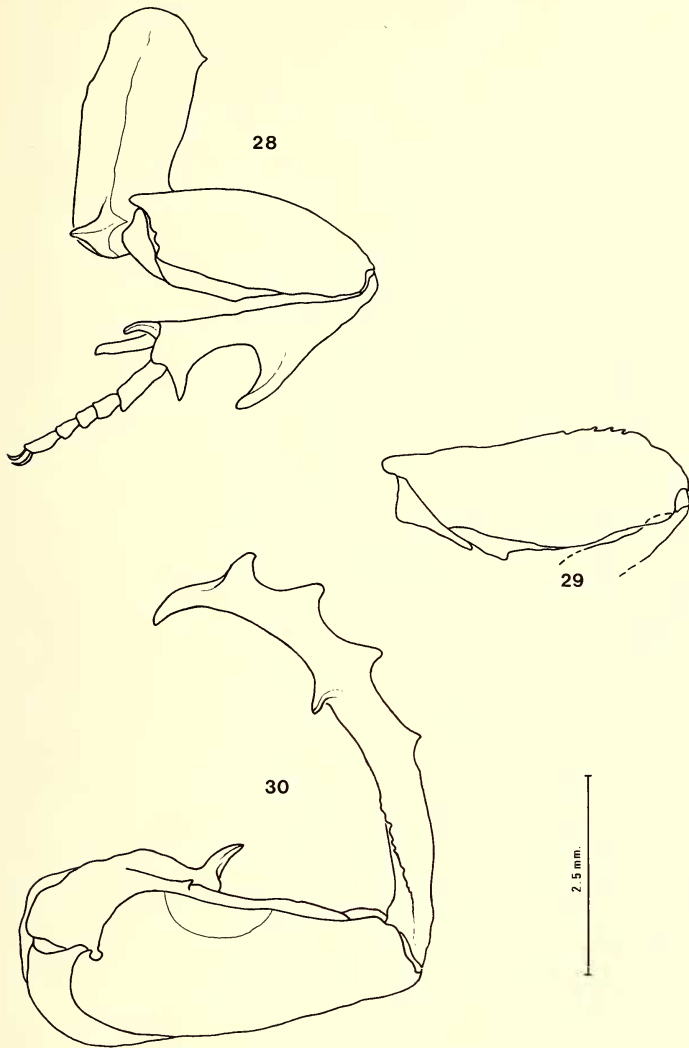
ii) In the fore tibia: reduction of the angular lamina of the internal side (figs. 27, 30 and 33).

iii) Enlargement of the external hull of the middle tibiae (figs. 28 and 31).

iv) Atrophy of the enlargement of the hind femora (figs. 29, 32 and 35).

v) Atrophy of the metasternal tubercles.

vi) Hipertrophy of the conic tubercle of the middle coxae, which in Eastern populations (*Ch. phoebus*) becomes laminar (figs. 28, 31 and 34).



Figs. 28 to 30: Legs of *Ch. pamphilus* and *Ch. phoebus*. Fig. 28: middle leg of *Ch. pamphilus*; fig. 29: hind femur of *Ch. pamphilus*; fig. 30: fore leg of *Ch. phoebus*.

The females of these three taxa are quite indistinguishable, except for little differences in the punctuation of the elytral intervals: which is simple in *Ch. irroratus*; granular or rough in *Ch. pamphilus* and *Ch. phoebus*. Thus this character would also be submitted to the same gradient of geographic variation as the male characters.

Aside from this gradient, table I shows another important aspect which favours considering these three taxa as different populations of the same species (see ahead, conclu-

Table 1. Variability of some external characters within different populations of *Cb. hungaricus irroratus* (Rossi).

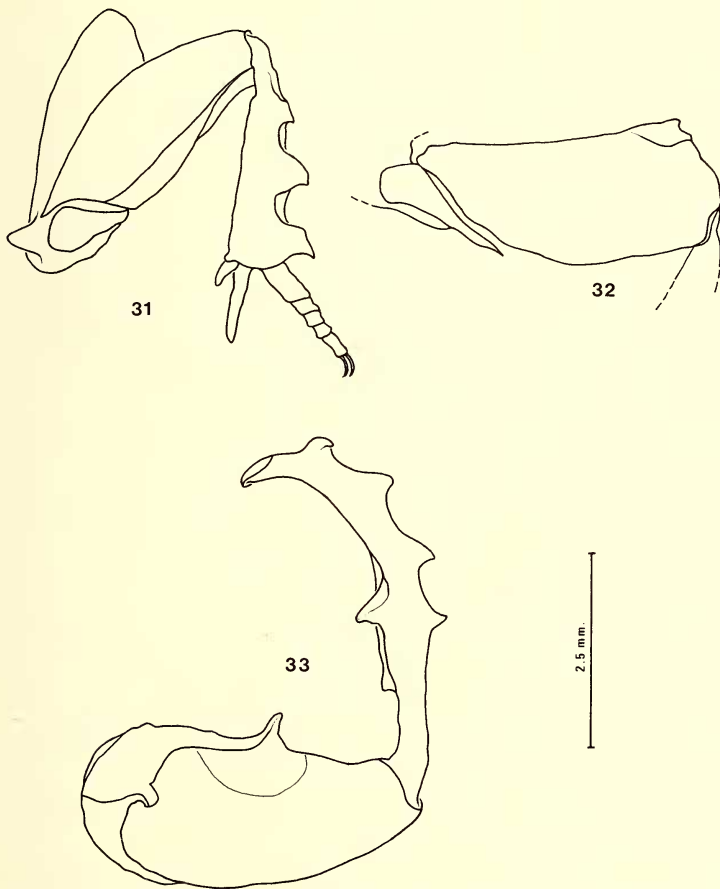
CHARACTERS	ANTERO- INFERIOR HULL OF THE FORE FEMUR	ANTERO- SUPERIOR HULL OF THE FORE FEMUR	INTERNAL SIDE OF THE FORE TIBIAE	EXTERNAL HULL OF THE MIDDLE TIBIAE	HIND FEMUR	META- STERNUM	PROCESSES OF THE MIDDLE COXAE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Cb. hungaricus irroratus</i>	With thorn. (Sometimes lacking)	With thorn.  Sometimes reduced to a small tooth, or even, lacking.	With angular hull.	Short.	Hind and fore border enlarged.	Tuberculate	Conic.  Sometimes lacking.
Mediterranean populations ( <i>Cb. irroratus</i> )	With thorn.	With thorn.	With angular hull.	Long.	Small toothed anterior border slightly enlarged.	Slightly tuberculate	Conic.  Sometimes lacking.
Western-asiatic populations. ( <i>Cb. pampbilus</i> )	Without thorn.	With thorn.	Without angular hull.	Long.	Not enlarged.	Smooth.	Laminar.  Sometimes lacking.
Central-asiatic populations. ( <i>Cb. phoebus</i> )	Without thorn.	With thorn.	Without angular hull.	Long.	Not enlarged.	Smooth.	Laminar.  Sometimes lacking.

sion no. 5): the individual variation of some characters within the same population and, consequently, a certain degree of mosaicism in some phenotypes.

5.— The development of the tectum, simple in *Ch. hungaricus*, dihedral angle in *Ch. irroratus*, is the only difference between the two taxa that can possibly be established (see descriptions and figures).

This feeble although constant difference in the male genitalia goes together with some external morphologic differences in the sculpture of the elytral integument and in the process of the fore femora. Contrary to *Ch. irroratus*, *Ch. pamphilus* and *Ch. phoebus*, these differences in the external morphology are constant between *Ch. hungaricus* and *Ch. irroratus* (figs. 26 and 27).

Taking into account the geographic distribution of these two last taxa (Northern mediterranean: *Ch. hungaricus* and Southern mediterranean: *Ch. irroratus*) (fig. 36) and



Figs. 31 to 33: Legs of *Ch. irroratus* and *Ch. pamphilus*. Fig. 31: middle leg of *Ch. irroratus*; fig. 32: hind femur of *Ch. irroratus*; fig. 33: fore leg of *Ch. pamphilus*.



their morphological and anatomical diagnostic characters, I think that both taxa are two subspecies which, from the nomenclatural point of view, should take the following names: *Chironitis hungaricus hungaricus* (HERBST, 1789) the nominal subspecies and *Chironitis hungaricus irroratus* (ROSSI, 1790) st. nov.

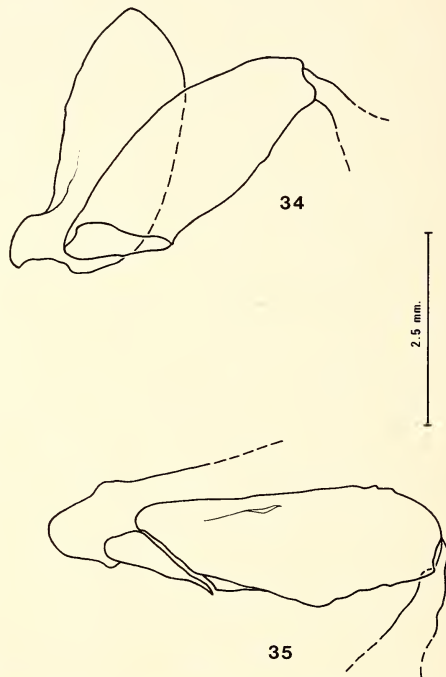


Fig. 34 and 35: *Ch. phoebus*. Fig. 34: middle leg; fig. 35: hind leg.

Therefore, according to my conclusions, the nomenclature and taxonomic problem of the *hungaricus* "complex" (x) is resolved as follows:

*Ch. hungaricus hungaricus* (HERBST, 1789) **ssp. nov.**

*Ch. hungaricus irroratus* (ROSSI, 1790) **st. nov.**

*Ch. pamphilus* (MÉNÉTRIES, 1849) **syn. nov.**

*Ch. phoebus* REITTER, 1893 **syn. nov.**

However, it must be emphasized that the discussion is not closed. A more exhaustive and detailed study of the geographic distribution of the Eastern-mediterranean (s. l.), Italian and Iberic populations of this species could eventually modify these conclusions (see the following zoogeographic discussion).

(x) The term "complex" is used here in a strict taxonomic sense.

## Zoogeography

In agreement with the taxonomical conclusions previously established and the corollary data known today, it seems logical to think that the geographic barrier which allowed the subspecific process of differentiation within *Ch. hungaricus*, has been solely the Mediterranean Sea.

Today we know that the geographic configuration of the mediterranean basin suffered strong modifications during the Neogen. Probably, the salinity crisis of the Upper Miocene (Messiniene) was most important for the process of taxonomic differentiation and dispersion of terrestrial fauna. Thus it is possible to think that during the period of complete drying of the Mediterranean and climatic aridity of the periphery, *Ch. hungaricus* (as a species) could colonize the whole Mediterranean Basin. Moreover, this hypothesis does not deny its xerotherm characteristics.

With the return of Sea water to the Mediterranean during the Pliocene, the barrier which allowed the genetic drift and subsequent taxonomic differentiation of both subspecies, would have been definitively established. If this hypothesis is true, the beginning of the process of subspeciation would go back to the lower Pliocene.

Although this hypothesis explains the taxonomic divergence of both subspecies in agreement with the biogeographic vicariance model, according to the bibliographic data there should exist some areas where the geographic boundaries of both subspecies overlap. These data are the following:

i) The presence of *Ch. hungaricus hungaricus* in the South and Center of the Iberian Peninsula (BAGUENA, 1967 and BARAUD, 1977).

ii) The presence of *Ch. hungaricus irroratus* in the greater part of Italy, where, according to the literature (PORTA, 1932), it would reach Toscana, to the North.

iii) If it is true that *Ch. pamphilus* and *Ch. phoebus* are synonyms of *Ch. irroratus*, both subspecies would coexist, according to the literature, in the Eastern Mediterranean (Thessalia – Greece – and South of European U.S.S.R. See for instance: JANSSENS; 1937; HORION, 1959; MIKSIC, 1956 and BALTHASAR, 1963) (x).

This evolves some interesting questions, from the taxonomic and biogeographic point of view, which are worthy of a more detailed commentary:

Without entering the polemic of the trustworthiness of the bibliographic citations, I think that the presence of subspecies *irroratus* in all these points may be attributed to the process of secondary spread, linked with, for instance, sea level oscillations, after the post-miocenic subspecific differentiation. Likewise, we must not exclude the possibility of occasional introductions related with the human presence. These ways of penetration

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(x) In the chapter on taxonomy, it has been pointed out that two series, one of *Ch. hungaricus hungaricus* and the other one of *Ch. hungaricus irroratus* are attributed to "Southern Europe". Such imprecision obliges one to omit these data from the zoogeographic discussion.

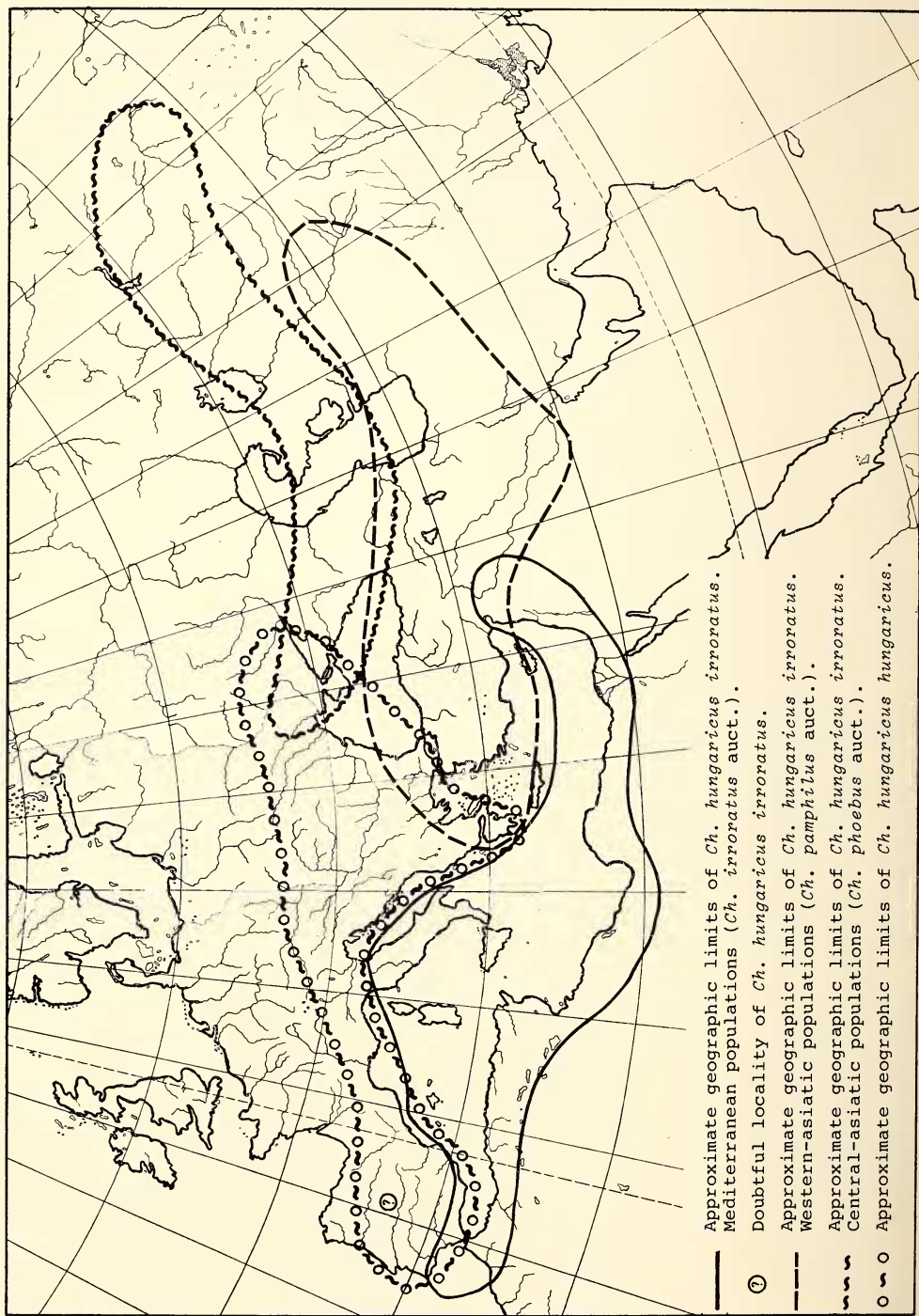


Fig. 36: Geographic distribution of the different populations of *Ch. hungaricus irroratus* and *Ch. hungaricus hungaricus*.

would also explain the presence of *Ch. furcifer* in the Northern Mediterranean (Yugoslavia, Albania, Bulgaria and European Turkey).

In Italy, the subspecies *irroratus* would have gone beyond the maritime barrier, its northern distribution limit reaching the line of the Tosco-Emiliano Appennino (PORTA, 1932). This seems to indicate that the subspecies in particular and the Italian mediterranean elements in general, have not been able to spread beyond the impassable mountain barrier (ZUNINO, pers. comm.).

The geographic barrier which prevented gene flow between both subspecies, after *Ch. hungaricus irroratus* had colonized the Iberian Peninsula, is not so apparent. In fact, accepting the trustworthiness of the most recent bibliographic citations (BARAUD, 1977), the geographic area of both subspecies seems to overlap, at least partially (see taxonomical chapter, the corological data of both subspecies). To this date, points of intersubspecific interbreeding are not known. Although the citations are less exact (Thessalia (Greece), Ukraine) identical considerations could be made with respect to the Eastern Mediterranean (JANSSENS, 1937; MIKSIC, 1956). Points of intersubspecific interbreeding are also unknown.

According to MAYR (1968), subspecies are potentially interbreeding. Thus, demonstrated sympatrical coexistence without interbreeding (in the Iberian Peninsula and Eastern Mediterranean) would confer a status of species, rather than subspecies.

However, before concluding that effectively *Ch. hungaricus* and *Ch. irroratus* are two different species, the geographic distribution, particularly in the Eastern and Western boundaries of the Mediterranean Basin, must be better known. Therefore, in the absence of more complete data, this taxonomic study, based on material examined directly by the author, indicates that the subspecific status of both taxa should be maintained.

### Phylogenetic considerations

The inference of the phyletic relationships within the ambit of any group requires, minimally, the study of the whole taxa-to-be-systematized, as well as the definition of an Out-group, which helps to establish the polarity of characters.

For this reason, the phyletic considerations put forth in the following are undoubtedly conditioned by the number of taxa studied in this work, twelve, which represent more than 80% of the palearctic fauna of *Chironitis*.

On establishing this first hypothesis, account has been taken of almost all mediterranean species of *Onitis* F., 1798 (*O. belial*; *O. ion*; *O. alexis septentrionalis*; *O. humerosus*; *O. ezechias*; *O. numida* and *O. damoetas*) and the three species of *Bubas* MULSANT, 1842 (*B. bubalus*; *B. bison* and *B. bubaloides*). These, as a conjunct and first approximation may be considered as Out-group with respect to the genus *Chironitis*, particularly the species of *Onitis*.

The basic ideas of the phyletic hypothesis are the following (fig. 37):

i) It is possible to recognize at least two basic evolutive lines within palearctic *Chironitis*:

*Ch. furcifer* + *Ch. sterculius* + *Ch. hauseri* and, probably, *Ch. candezei* (x) presently the most primitive; and a second, derived, represented by *Ch. haroldi* + *Ch. moeris*, and by that which I have named *hungaricus* complex. An external lateral sinus in the co-

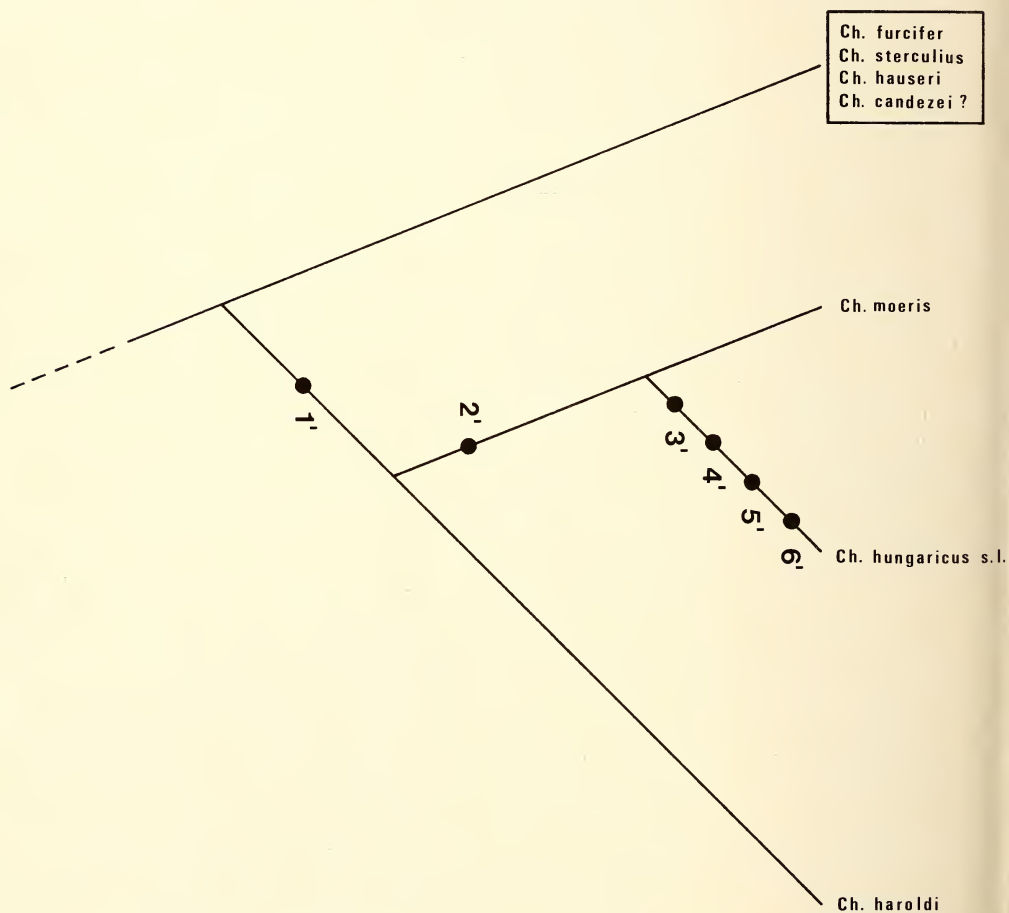


Fig. 37: Diagram of the hypothetical relationships of the palearctic species of *Chironitis*.

(x) The uncertainty in the phyletic position of *Ch. candezei* is due to the fact that at present we know only one specimen (♀) of this species. For the same reasons *Ch. granulipennis* has not been presently taken into account in the phyletic hypothesis.



pulatrix lamina (1') determines its line branched-rank. This character may be understood to be an apomorphy with respect to the copulatrix lamina of the *Bubas* and above all, *Onitis* species.

ii) Two different evolutive patterns that suggest the existence of a second cladogenic event at the base of the derived evolutive line can be inferred from the spatial configuration of said sinus. The consequence of this second cladogenesis would have been the branching off from the primitive (whose single present representative would be *Ch. haroldi*) into a second derived line, represented today by *Ch. moeris* and *Ch. hungaricus* (s. l.). These species are carriers of an apomorphic character, the structural modification of the external lateral sinus of the copulatrix lamina, resulting from the partition of the external margin of said lamina into a small dorsal lobe (which is a continuation of the ventral border of the tectum) and a ventral one, internally joined with the former (2').

The plesiomorphic state of this character is, according to my hypothesis, that which *Ch. haroldi* shows, that is to say, a simple internal projection of the external margin, which is articulated in the ventral region of the tectum, but is never separated into two lobes (compare descriptions and figures of the three species).

iii) Characteristic apomorphies of the *Ch. hungaricus*, such as hirsute paranal sclerites (♀) (3'); reduction of the dorsal lobes of the paramere's apex (4'); greater development of the tectum (5') and the dorsal and ventral lobes of the copulatrix lamina (6') indicate that this species represents a clearly derived line with respect to that which presently represents *Ch. moeris*.

This hypothesis may be tested after the study of all the species which make up the genus *Chironitis*.

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